

**GOAL-DIRECTED SELF-MONITORING AS AN ECOLOGICAL MOMENTARY  
INTERVENTION FOR DISORDERED EATING THOUGHTS AND BEHAVIORS**

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## ABSTRACT

The present study investigated the use of self-monitoring with goal-directed feedback as an ecological momentary intervention for reducing the frequency of disordered eating and body checking behaviors over a two-week period. This study also examined if self-monitoring significantly reduced baseline eating disorder pathology at post-test. Sixty-seven college-age women with subclinical eating disorder pathology were randomized into one of three groups: a non-directed EMI group that engaged in two weeks of self-monitoring (NG-EMI group); a goal-directed EMI that, in addition to completing the two-week self-monitoring period, received daily text messages containing goal-directed and psychoeducation; and a control group that completed only the pre- and post-tests. Participants in the EMI groups were prompted via text message five times per day to record recent disordered eating and body checking behaviors as well as their state body dissatisfaction (i.e., BISS) and state negative affect (i.e., PANAS-X). All participants completed online pre- and post-test measures of body shape concern, global eating disorder pathology, and body checking and avoidance behavior. EMI participants also reported feasibility and acceptance of the EMI procedures at post-test. Hierarchical linear modeling revealed greater momentary disordered eating and body checking significantly predicted greater state body dissatisfaction and negative affect. Results also suggested both EMI groups reported significantly fewer disordered eating and body checking behaviors over time. Body checking, but not disordered eating behaviors, reduced significantly faster in the G-EMI group compared to the NG-EMI group. The G-EMI group reported less eating disorder pathology at post-test compared to the NG-EMI group and control group. EMI participants indicated overall feasibility and acceptance of the self-monitoring intervention. The present results suggested self-monitoring, specifically with the addition of goal-directed and psychoeducational information, might be an effective intervention for reducing disordered eating and body checking behaviors over time in women with subclinical eating disorder pathology. Clinical implications, study limitations, and future directions for research are discussed.

## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b> .....	ii
<b>ABSTRACT</b> .....	iii
<b>LIST OF TABLES</b> .....	vi
<b>LIST OF FIGURES</b> .....	vii
<b>CHAPTER 1. INTRODUCTION</b> .....	8
The Cognitive-Behavioral Model of Eating Disorders .....	8
Eating Disorder Treatment: CBT and Self-Monitoring .....	11
Self-Monitoring and Ecological Momentary Assessment .....	13
Self-Monitoring and Reactivity .....	14
Factors Affecting Reactivity .....	17
Ecological Momentary Intervention .....	18
Eating-Related EMI and Self-Monitoring Research .....	19
Eating Disorder Symptomology in College Populations .....	21
Present Study .....	22
<b>CHAPTER 2. METHOD</b> .....	25
Participants .....	25
Pre-Post Test Measures .....	25
Demographic Questionnaire .....	26
Valence of Target Behaviors .....	26
Eating Disorder Symptomatology .....	26
Body Shape-Related Perceptions and Behaviors .....	27
Social Desirability .....	28
EMI Feasibility and Accuracy .....	29
EMI Measures .....	30
Eating- and Weight-Related Thoughts and Behaviors .....	30
State Negative Affect .....	31
State Body Dissatisfaction .....	32
Daily Text Message Intervention .....	33
Manipulation Check .....	33
Procedure .....	34
Pre-Screen .....	34
EMI Procedures .....	35
Statistical Analyses .....	39
Preliminary Analyses .....	39
Multilevel Modeling .....	40
Hypothesis 1 .....	41
Hypothesis 2 .....	41
Hypothesis 3 .....	42
Hypothesis 4 .....	42
Hypothesis 5a .....	42
Hypothesis 5b .....	43
<b>CHAPTER 3. RESULTS</b> .....	44
Sample Description .....	44

Study Groups .....	45
Social Desirability .....	46
Valence of Target Behaviors .....	46
Manipulation Check .....	47
EMI Compliance .....	47
Aggregate and Descriptive Analyses .....	48
Most Recent Eating Episode .....	48
Disordered Eating Behaviors .....	48
Body Checking Behaviors .....	49
Multilevel Analyses .....	50
Missing Data .....	50
Outliers and Assumptions .....	51
Intraclass Correlation Coefficient .....	51
Final Models .....	52
Hypothesis 1 .....	52
Hypothesis 2 .....	55
Hypothesis 3 .....	57
Hypothesis 4 .....	58
Hypothesis 5a .....	61
Hypothesis 5b .....	61
<b>CHAPTER 4. DISCUSSION</b> .....	65
Strengths and Limitations .....	71
Clinical Implications and Future Directions .....	74
<b>APPENDICES</b> .....	77
APPENDIX A .....	77
APPENDIX B .....	81
APPENDIX C .....	85
APPENDIX D .....	89
APPENDIX E .....	91
APPENDIX F .....	92
APPENDIX G .....	94
APPENDIX H .....	98
APPENDIX I .....	99
APPENDIX J .....	100
APPENDIX K .....	101
APPENDIX L .....	103
APPENDIX M .....	104
<b>REFERENCES</b> .....	105

## LIST OF TABLES

Table 1	<i>Descriptive Statistics and Mean Pre-Test Scores for Total Study Sample</i> .....	45
Table 2	<i>Mean Responses to Most Recent Eating Episode Descriptive Questions for Total EMI Sample</i> .....	48
Table 3	<i>Aggregate Breakdown of Reported Eating Disorder Behavior Frequencies for Total Sample and by EMI Group</i> .....	49
Table 4	<i>Aggregate Breakdown of Reported Body Checking Behavior Frequencies for Total Sample and by EMI Group</i> .....	50
Table 5	<i>Disordered Eating Frequency and Body Checking Behavior Frequency as Predictors of Eating Pathology at Last Meal, State Body Dissatisfaction, Negative Affect for all EMI Participants</i> .....	54
Table 6	<i>Variance Explained at Level 1 and Level 2 for Outcome Variables with ED and BC Frequency Included as Predictors</i> .....	55
Table 7	<i>Variance Explained at Level 1 and Level 2 for Outcome Variables with Time in Study Included as a Predictor</i> .....	57
Table 8	<i>One-Way ANOVA Results for Comparison of Pre-Test Scores by Study Group</i> .....	58
Table 9	<i>Mean Pre- and Post-Test Scores and T-Test Statistics for Each Study Group</i> .....	60
Table 10	<i>Mean Responses to EMI Feasibility and Accuracy Questions at Post-Test</i> .....	62
Table 11	<i>Responses to Open-Ended Prompt for Study Feedback at Post-Test</i> .....	64

## LIST OF FIGURES

Figure 1	<i>Flow Chart of Random Assignment Procedures</i> .....	36
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## **CHAPTER 1. INTRODUCTION**

Eating disorders remain a pervasive psychiatric problem among young women (Hudson, Hiripi, Pope, & Kessler, 2007; Stice, 2001). Characteristics of eating disorders include a persistent and often chronic course, co-occurrence of other psychopathology and medical complications, and high mortality rates (Thompson & Stice, 2001). Recent epidemiological findings estimate that 0.9% of women will suffer from anorexia nervosa in their lifetime, 1.5% from bulimia nervosa, and 2.8% from binge eating disorder (Hudson et al., 2007; Smink, van Hoeken, & Hoek, 2012). Research further suggests the presence of subclinical eating disorder symptoms can result in significant psychological and physical impairment (Ackard, Croll, & Kearny-Cooke, 2002; Hoffman & Brownell, 1997; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). These findings underscore the importance of not only treating and preventing eating disorders but subclinical symptoms as well.

### **The Cognitive-Behavioral Model of Eating Disorders**

The etiology and treatment of disordered eating are multi-faceted, and many cognitive and behavioral factors have been identified as important components to consider. Cognitive behavioral theory suggests disordered eating is primarily maintained through an individual's overevaluation of and extreme need for control over his or her weight, shape, and eating behavior (Fairburn, Cooper, & Shafran, 2003). The result of this overevaluation and need for control typically manifests as excessive dietary restriction. The theory posits that the need for control arises from a preexisting sense of ineffectiveness and perfectionism and that these individuals may attempt to control other aspects of their lives before becoming overly focused on weight and eating behaviors. The experience of a chaotic environment or a loss of control may lead the individual to focus on areas of their lives in which they perceive they are able to exert



control. For individuals who value aestheticism, the notion that outward appearance is of great importance in determining overall self-worth, eating is likely to become a primary focus due to the fact that effortful dietary restriction often results in weight loss, which is viewed as an immediate visual and direct representation of self-control (Fairburn et al., 2003).

Fairburn et al. (2003) proposed that once the restricting behavior begins, it is maintained by three mechanisms that cause the eating disorder to become self-perpetuating. The first mechanism involves dietary restraint and its effect on an enhanced sense of being in control. “Successful” dietary restraint resulting in weight loss produces an increased sense of self-control, which is directly tied to an individual’s perception of their self-worth. As a result, the individual may restrict both calories and types of food and, if successful, subsequent weight loss will act as positive reinforcement for further restrictive behavior.

The second mechanism thought to maintain eating disorders involves aspects of starvation that encourage further dietary restriction (Fairburn et al., 2003). Continuous dietary restraint will result in weight loss and eventual starvation behaviors. These physiological and psychological changes promote further restriction due to the fact that they can “threaten” the person’s sense of being in control (Dalle Grave, Di Pauli, Sartirana, Calugi, & Shafran, 2007). For instance, the intense hunger and preoccupation around food that results from excessive dietary restriction may be perceived as a threat to control over eating. Impaired concentration due to lack of adequate calories and nutrition may cause difficulty following events and thus result in the perception that the events are unpredictable, further threatening the sense of self-control. Experiencing these threats may exacerbate dietary restriction behaviors in order for the individual to regain their sense of control and self-worth.

The final mechanism thought to perpetuate eating disorders is the existence of an extreme concern about weight and shape (Fairburn et al., 2003). This mechanism is related to the culture-specific idealization of thinness in Westernized societies (Stice & Shaw, 1994). Due to the internalization of the thin ideal, the weight loss experienced through dieting and restricting further promotes a sense of self-worth. Because the weight loss is the main source of self-worth and control, weight and shape will begin to be monitored with extreme vigilance.

This monitoring of weight and shape may manifest as frequent body checking, which is defined as any behavior intended to gain information about one's size, weight, shape, or appearance (Walker & Murray, 2012). Examples of body checking include repeatedly weighing oneself, scrutinizing body parts in the mirror, feeling or pinching body parts to measure size, and comparing one's body size to others. Repeated checking of disliked body parts may further increase vigilance of weight and shape and result in the belief that certain parts of the body are too large, particularly when the individual is in a state of emotional distress (Fairburn et al., 2003). This may result in increased checking and vigilance, negative affect, and body dissatisfaction, forming a harmful cycle (Fairburn et al., 2003). As checking frequency and body dissatisfaction increase, individuals may engage in increasingly disordered eating behaviors.

Eventually, hypervigilance about body shape, eating, and appearance-related behaviors may consume a significant portion of the individual's mental resources, and checking may become so aversive and punishing that the individual begins to engage in body avoidance behaviors. While body checking is more associated with dietary restriction, body image avoidance has been shown to be significantly associated with binge eating (Walker & Murray, 2012). After an individual engages in binge eating or an eating episode in which they feel a loss of control over eating, they may be more likely to avoid body checking out of fear of

confirmation of weight gain. In this instance, avoidance acts as a negative reinforcement for future binge eating behaviors. Further, it is not uncommon for individuals with disordered eating to alternate between body checking and body avoidance behavior, particularly those with high levels of body concern and body dissatisfaction (Walker & Murray, 2012). Due to these mechanisms, body checking and body avoidance have been described as important maintenance factors for disordered eating behavior, and they are often targets for intervention in psychological treatment (Fairburn et al., 2003).

### **Eating Disorder Treatment: CBT and Self-Monitoring**

Cognitive behavior therapy (CBT) is one of the most effective treatments for eating disorder pathology within adult populations (e.g., Murphy, Straebl, Cooper, & Fairburn, 2010; Vocks et al., 2010; Whittal, Agras, & Gould, 2000; Wilson, Grilo, & Vitousek, 2007). CBT for eating disorders targets the cognitive and behavioral mechanisms that maintain or exacerbate the eating disorder, such as rigid dieting, overevaluation of weight and shape, and body checking (Fairburn, Cooper, & Shafran, 2003). Treatment can also address broad and complex factors that may contribute to disordered eating or complicate treatment progress, such as low mood intolerance, clinical perfectionism, low self-esteem, and interpersonal difficulties (Fairburn et al., 2003).

A substantial component of CBT is self-monitoring, in which patients monitor unwanted thoughts, emotions, or behaviors throughout a period of time between treatment sessions (Beck, 2011; Korotitsch & Nelson-Gray, 1999). Self-monitoring can provide essential information about antecedent and consequent events associated with eating behaviors and negative mood (Zotter & Crowther, 1991, Wilson & Fairburn, 1993) and rich assessment data within the context of ongoing treatment (Wilson & Vitousek, 1999).

In traditional in-person CBT for eating disorders, self-monitoring is introduced to the patient within the first session and it is typically used throughout the course of treatment (Fairburn, 2008; Waller et al., 2007). Patients may use paper-and-pencil self-monitoring forms to record their daily food intake, associated feelings of hunger and fullness, bingeing and purging behaviors, mood, body checking, and other related thoughts and behaviors. Fairburn and Rothwell (2015) described two major purposes of self-monitoring in CBT for eating disorders: 1) to provide an ongoing examination of key clinical features; and 2) to help patients change. Self-monitoring of eating behaviors and thoughts, as well as their influential antecedents and consequences, allows patients to observe and understand these instances as they occur and potentially make changes in real-time and independently between therapy sessions (Fairburn, 2008; Waller et al., 2007).

For example, a patient may be self-monitoring her food intake, associated mood states, and body checking behavior (e.g., weighing herself, prolonged examination of body size in the mirror, etc.) throughout the day. After collecting data for several days, the patient or therapist may notice a number of patterns, antecedents, and consequences in her behavior. During mornings in which the patient engaged in rigorous body checking, she was more likely to experience negative emotions and thoughts about her shape and weight. This caused her to skip breakfast, which resulted in a higher likelihood that she would engage in binge eating in the afternoon. Before collecting self-monitoring data, the patient may not have been aware of the occurrence or effects of her body checking or subsequent dietary restriction (Fairburn, 2008; Walker & Murray, 2012). These findings can inform the patient and therapist of necessary behavioral changes or interventions (e.g., reduce body checking in the mornings, eat breakfast to avoid severe hunger and avoid binge eating in the afternoon, etc.).

## **Self-Monitoring and Ecological Momentary Assessment**

Treatment manuals for CBT for eating disorders typically provide paper-and-pencil self-monitoring record forms for patients to keep on their person throughout the day (Fairburn, 2008; Waller et al., 2007). Patients are encouraged to complete their records as soon as possible after eating, particularly if binge eating or inappropriate compensatory behavior has occurred. Continuous self-monitoring may be a more accurate method of assessing the frequency of disordered eating behaviors compared to retrospective reports provided in treatment sessions (Grilo, Masheb, & Wilson, 2001). Additionally, with the recent proliferation of smartphones (e.g., iPhone, Android, etc.) with Internet capabilities and easy-to-use interfaces, self-monitoring may be conducted using applications (“apps”) or note-taking software on these devices. Because most individuals own a smartphone and are likely to keep it on their person throughout the day, electronic versions of self-monitoring may be a more convenient and reliable methods of tracking for patients (Kuntsche & Labhart, 2013).

A review by Fairburn and Rothwell (2015) identified 39 available smartphone apps designed for people with eating disorders, five of which were primarily self-monitoring tools for patients to track their eating behaviors. However, the authors determined that these apps lacked flexibility in the type of information a patient could enter, and it was difficult for both patients and therapists to view the cumulated information throughout the day. Fairburn and Rothwell (2015) assert that in order for self-monitoring to help patients change, the chosen method of self-monitoring (e.g., paper-and-pencil form, smartphone app, etc.) must allow the patient to easily enter and view data in order to be able to observe what has happened during the day and on previous days. By doing so, patients may gain a better understanding of their eating behaviors, identify patterns, and make necessary changes.

Though it appears that further development is needed on self-monitoring apps for treatment purposes, electronic forms of self-monitoring have been used with increasing frequency in research settings via ecological momentary assessment (EMA). EMA, also called experience sampling or ambulatory assessment, is a sampling method in which participants' behaviors and/or thoughts are repeatedly measured in their natural environments over a period of time. This data collection method allows for maximum ecological validity, minimizes recall bias, and is beneficial for capturing micro-processes over time (Kuntsche & Labhart, 2013). Eating disorder-related EMA studies often involve continuous self-monitoring of specific eating disorder behaviors as well as other related variables, such as body image dissatisfaction, momentary affect, social media use, and substance use (Smyth et al., 2001). Participants are typically prompted to self-record their behavior numerous times per day for a period of one to two weeks via a pre-programmed digital device, text messages containing a link to an online questionnaire, or a pre-programmed app on their personal mobile devices. EMA provides an extremely rich dataset that is captured in the participants' natural environment in real time, which allows the researcher to examine complex relationships between transient or state-dependent variables (i.e., mood and body checking) that would have otherwise been difficult to capture in a traditional laboratory setting (Smyth et al., 2001).

### **Self-Monitoring and Reactivity**

A well-established effect of self-monitoring is reactivity, in which the targeted thoughts and/or behaviors change in frequency over time due to the self-monitoring procedures (Nelson & Hayes, 1981). Reactivity to self-monitoring may occur in both treatment and research settings. When self-monitoring is used for purely assessment purposes, reactive effects may be considered an unwelcomed confounding variable. However, reactive changes due to self-monitoring

typically occur in a desirable direction (i.e., reduction in frequency of undesirable behaviors or increased frequency of desirable behaviors), which may provide an ancillary component to maximize treatment progress (Korotitsch & Nelson-Gray, 1999; Nelson & Hayes, 1981; Robbins & Kubiak, 2014). Therefore, self-monitoring has been described as both an assessment tool and a treatment intervention due to the reactive changes that often occur in the monitored behaviors (Korotitsch & Nelson-Gray, 1999).

Reactive effects of self-monitoring have been well established in many different areas of health behavior research, including cigarette smoking (e.g., Abrams & Wilson, 1979; McFall & Hammen, 1971), obesity and weight loss (e.g., Burke, Wang, & Sevvick, 2011), panic and anxiety (e.g., Craske & Tsao, 1999), chronic pain (e.g., Cruise et al., 1996), and substance use (e.g., Litt, Cooney, & Morse, 1998). However, research examining the reactive effects of self-monitoring eating disorder behaviors is limited, and existing findings have been somewhat mixed. In Latner and Wilson (2002), women with either bulimia nervosa or binge eating disorder monitored their food intake, the time and place of intake, whether they considered the eating episode to be a meal, snack, or binge, and if they experienced a loss of control over their eating. Results indicated there was a significant reduction in binge eating episodes per day during the two-week self-monitoring period. Although this study lacked a comparison group, participants did not receive any additional simultaneous treatment, which suggests the reduction of binge eating may have been a reactive effect of self-monitoring food intake. Further, in an EMA study conducted by Stefano, Hudson, Whisenhunt, Buchanan, and Latner (2016), non-clinical college-age women with high body concern were contacted five times per day for five days and were asked to report the number of times they engaged in body checking behaviors since they were last contacted, and their current negative affect and body dissatisfaction. Results indicated the reported frequency of

the body checking behaviors significantly reduced over the five-day EMA period, suggesting a possible reactivity to self-monitoring these behaviors.

However, some studies have reported limited or no significant reactive effects to self-monitoring eating disorder behaviors. Stein and Corte (2003) used EMA to measure five eating disorder behaviors (binge eating, vomiting, laxative use, diuretic use, and excessive exercise) over the course of four weeks in women with clinically diagnosed eating disorders. The authors concluded there was no evidence of reactivity to self-monitoring because there were no significant changes in eating disorder behavior frequency when examining the first two weeks compared to the last two weeks of the study. However, the sample size in this study was small ( $n = 16$ ), and the authors used a statistical approach involving aggregated data across participants and weeks, rather than a multilevel modeling approach, which is strongly recommended for the nested data yielded from EMA in order to retain variability between and within individuals. Another EMA study assessed reactive effects in individuals with binge eating disorder after they were asked to self-monitor their binge eating behavior for one week (Munsch et al., 2009). Results showed the reported number of daily binge eating episodes remained stable during the one-week self-monitoring period, suggesting there were no indications of reactivity. It is possible reactivity was not observed in this study due to the brevity of the self-assessment period and the severity of the target behaviors (i.e., binge eating), which may not be notably influenced by reactivity within the span of one week.

Another potential concern is the occurrence of reactivity in the *opposite* of the desired direction, resulting in an increase in eating disorder behaviors. Women with disordered eating symptoms may be at particular risk for this due to their already existing preoccupation about weight and shape. It should be noted that the majority of existing eating disorder studies that



have examined reactive effects of self-monitoring have not observed a significant increase in the negative target behaviors, but rather there was no change or a reduction in the behaviors.

However, some reactive effects could be due to a shift in behavior rather than a complete reduction. For example, a study by Hildebrandt and Latner (2006) found that self-monitoring binge eating behaviors resulted in a reduction of objective binge eating episodes but an *increase* in subjective binge eating episodes. Due to these limited and mixed findings on reactive effects of self-monitoring eating disorder behaviors, continued research is needed.

### **Factors Affecting Reactivity**

Theorists have suggested a number of mechanisms that may contribute to reactivity during self-monitoring. One important mechanism is the valence of the targeted behavior (Kazdin, 1974). Behaviors that have been identified as positively valenced (e.g., drinking water throughout the day) may increase in frequency while they are self-monitored, while behaviors that are negatively valenced (e.g., smoking cigarettes) may decrease in frequency. Additionally, Korotitsch and Nelson-Gray (1999) identified motivation for change as an important variable affecting reactivity. The authors concluded that an individual is likely to demonstrate measureable reactivity while self-monitoring if he or she has salient motivation to change the target behavior.

Kazdin (1974) also described a number of tactics to increase reactivity in the desired direction. One important technique is explicit goal setting. When an individual is aware of the goal or purpose of their self-monitoring (e.g., to reduce unwanted target behaviors over time), he or she is more likely to react in a desired way (Mace & Kratochwill, 1985). However, the authors note the existence of social desirability, the tendency to respond in a manner that will be viewed favorably by others, may affect participants' reporting of their behaviors and should be

considered as a potential contributing variable to behavioral change. This method of goal setting is consistent with CBT for eating disorders. Treatment goals are frequently set throughout treatment, and the goal and rationale for self-monitoring is explicitly discussed with patients during its introduction (Fairburn, 2008; Waller et al., 2007). Patients are told that a major purpose of self-monitoring during eating disorder treatment is to obtain the most accurate record possible of their eating behaviors and thoughts so that they may use this information to identify areas for change or intervention. Further, the cognitive behavioral theory of disordered eating (Fairburn et al., 2003) lends itself to the use of self-monitoring as an intervention. For example, those with high levels of body dissatisfaction and disordered eating may frequently engage in body checking, a behavior that likely maintains their sense of body dissatisfaction, negative affect, and disordered eating behaviors. When a patient begins to systematically self-monitor their otherwise unnoticed body checking behavior, they may gain increased awareness of the frequency of the behavior and better observe its effects on other variables, such as mood or dietary restriction (Fairburn, 2008; Walker and Murray, 2012).

### **Ecological Momentary Intervention**

With the occurrence of reactivity, self-monitoring or EMA may be appropriately labeled and used as a type of ecological momentary *intervention* (EMI), with the intention to reduce the frequency of the targeted disordered eating behaviors over time. An EMI is a treatment characterized by the delivery of mobile technology-based interventions to patients while they are in their natural environment (Heron & Smyth, 2010). A review by Heron and Smyth (2010) suggested that EMI protocols are typically well received by patients and effective in treating a variety of health behaviors and psychological symptoms, including obesity, substance abuse, and anxiety-related behaviors. Similar to EMA, EMIs may be delivered to participants via

independent phone apps or through the use of text messages; both methods are feasible for participants and effective in achieving desired clinical outcomes for eating and other health behaviors (e.g., Fjeldsoe, Marshall, & Miller, 2009; Heron & Smyth, 2010).

### **Eating-Related EMI and Self-Monitoring Research**

Although the literature is growing, there are few published eating-related EMI studies examining self-monitoring as an intervention. The majority of eating-related EMI studies with a self-monitoring component have targeted obesity and weight management behaviors, most of which have shown clinical and significant levels of success in achieving desired short-term treatment outcomes (e.g., Agras et al., 1990; Fjeldsoe et al., 2009; Campbell et al., 1994; Patrick et al., 2009; Woolford, Clark, Strecher, & Resnicow, 2010).

Some existing studies have examined the effectiveness of EMI self-monitoring used in conjunction with in-person CBT or as a post-treatment tool to maintain progress (Bauer et al., 2003; Robinson et al., 2006). For example, Shapiro et al. (2010) examined a text-message self-monitoring program for patients with bulimia nervosa used concurrently with in-person CBT. A total of 31 participants attended a 12-week CBT group for bulimia nervosa. At the end of each day, participants submitted a text-message in which they reported the number of binge eating and purging episodes that occurred that day as well as their daily ratings for their urges to binge and purge. The majority of participants (87%) adhered to the self-monitoring text messages, and participants showed a significant reduction in bulimic symptomology from baseline to post-treatment and follow-up. Although this study lacked a comparison group, feedback from participants indicated feasibility and perceived effectiveness of self-monitoring via text messages in conjunction with in-person treatment.

The majority of existing research on the treatment function of self-monitoring in eating disorders has examined clinically severe behaviors, such as binge eating and self-induced vomiting. However, it is possible reactive effects occur more notably when self-monitoring other associated thoughts and behaviors, such as body checking, negative weight-related thoughts, emotional eating, and negative affect. In an EMA study conducted by Stefano et al. (2016), frequency of body checking behavior significantly reduced during a 5-day self-monitoring period, which may have been a reactive effect to self-monitoring. Another EMA study examining the effects of social comparisons on body dissatisfaction, negative affect, and compensatory behaviors found that participants reported significantly less instances of appearance-related social comparison at the end of the five day self-monitoring period compared to the beginning of the study; however, the authors stated there were no reactive effects on other study behaviors. (Leahy, Crowther, & Ciesla, 2011).

A study by Heron and Smyth (2013) suggested intensive measurement of body image using an EMA protocol did not yield significant reactive effects. In the study, participants completed five daily surveys for one week, which included questionnaires related to body image discrepancy, or the perceived discrepancy between one's "ideal" and "actual" body image. Results indicated there was no systemic change in momentary body discrepancies during the one week of EMA protocol. However, continuous self-assessment of internalized experiences of body image discrepancy may not be influenced by reactivity, while self-reporting the frequency of more overt and objective behaviors, such as body checking, may be more applicable.

In Cash and Hrabosky (2003), college-age women with high body dissatisfaction completed a self-administered body image program that included a psychoeducation component and continuous self-monitoring of body image experiences and situations throughout the day for

three weeks. The psychoeducation materials included information about cognitive behavioral processes that maintain body image dissatisfaction and its impact on psychosocial functioning. Results suggested at the end of the study period, participants reported significantly less body dysmorphia, less overall appearance evaluation, and less weight-related concern and preoccupation; additionally, overall compliance to the self-monitoring protocol was associated with better outcome (Cash & Hrabosky, 2003). Incorporating psychoeducation in self-monitoring procedures may be an effective way to influence the perceived valence of the target behaviors, increase motivation to change the behaviors, and provide goal-directed information, factors which can further increase the reactive effects of self-monitoring in the desired direction (Korotitsch & Nelson-Gray, 1999).

Overall, findings are limited and inconsistent, and further research is needed to investigate if self-monitoring and its associated reactive effects can be used as an effective ecological momentary intervention for disordered eating, particularly for behaviors other than binge eating and compensatory behaviors. Further, it is unknown if including explicit goal-directed information and a psychoeducational component with the EMI self-monitoring protocol will result in an even greater level of reactivity during the self-monitoring period. This has not yet been explicitly and systematically examined within a controlled research context in either clinical or subclinical populations.

### **Eating Disorder Symptomology in College Populations**

Subclinical disordered eating cognitions and behaviors remain pervasive among college-age women (Berg, Frazier, & Sherr, 2009; Eisenberg, Nicklett, Roeder, & Kirz, 2011; Krahn, Kurth, Gomberg, & Drewnowski, 2005). Krahn et al. (2005) suggested up to two-thirds of college women engaged in “intense” dieting or dieting that put them at risk for an eating disorder

(i.e., participants endorsed binge eating, pathological weight control behaviors, and/or extreme concern about shape and weight). Furthermore, Delinsky and Wilson (2008) found that eating disorder symptomology and concern about weight gain increased significantly within the first year of college among undergraduate females. Frequency of dieting behaviors is strongly associated with negative emotions, health risk behaviors, and other mental health concerns (Ackard et al, 2002).

Due to the pervasiveness of dieting and body dissatisfaction (Klemchuk, Hutchinson, & Frank, 1990), college-age women with high body concern are an appropriate population for disordered eating-related intervention and prevention efforts. A number of prevention programs and interventions for disordered eating behaviors have been implemented with significant success (e.g., Schwitzer, Bergholz, Dore, & Salimi, 1998; Stice, Shaw, & Marti, 2007; Stice, Rohde, Durant, & Shaw, 2012; Taylor et al., 2006; Winzelberg et al., 2000). These programs have used numerous intervention strategies such as providing psychoeducation about eating, weight, and body image, cognitive dissonance techniques to challenge the thin ideal, and improving media literacy. However, no study exists investigating the use of self-monitoring and associated reactive effects as a sole intervention for disordered eating among non-clinical undergraduate females. College-age women with high body concern are an appropriate target for investigating the efficacy of such an intervention and may provide preliminary data regarding its effectiveness and feasibility for use within other populations.

### **Present Study**

The present study aimed to further explore the associations between body checking, state body dissatisfaction, and negative affect as well as investigate the feasibility, acceptability, and efficacy of using an EMI of goal-directed self-monitoring for disordered eating thoughts and

behaviors among non-clinical women with high body concern. Participants were randomized to three groups: a goal-directed EMI group that engaged in self-monitoring with goal-directed information and psychoeducational components (G-EMI group), a non-directed EMI group that engaged in only self-monitoring without explicit direction, goals, or psychoeducation (NG-EMI group), and a control group that did not receive any intervention or engage in any self-monitoring (i.e., pre/post-test only). Five exploratory research aims and hypotheses were examined:

*Research Aim 1:* To replicate previous findings (Stefano et al., 2016) on the associations between momentary disordered eating and body checking behaviors, state body dissatisfaction, and state negative affect among women with high body concern. Establishing the relationships between these constructs in a subclinical population will provide further rationale for the need to target these behaviors for intervention.

*Hypothesis 1:* For all participants engaging in self-monitoring (i.e., NG-EMI and G-EMI groups), higher reported frequency of disordered eating behavior and body checking behavior will predict the concurrent presence of higher levels of state body dissatisfaction and state negative affect.

*Research Aim 2:* To investigate potential reactive effects of self-monitoring as an ecological momentary intervention for reducing the frequency of disordered eating and body checking behaviors over the 14-day self-monitoring period.

*Hypothesis 2:* During the 14-day EMI protocol, all participants who engage in self-monitoring (i.e., participants in the NG-EMI and G-EMI study groups) will show a significant reduction over time in the frequency of disordered eating and body checking behaviors reported on the EMI questionnaires.

*Research Aim 3:* To determine if including goal-directed information and psychoeducation in addition to the self-monitoring procedures results in a greater amount of reactivity, or reduction of target behaviors, compared to self-monitoring alone.

*Hypothesis 3:* Participants in the G-EMI group will show significantly greater reduction in self-reported frequency of disordered eating and body checking behaviors over the 14-day EMI study period compared to the NG-EMI group.

*Research Aim 4:* To investigate the potential impact of continuous goal-directed self-monitoring of disordered eating and body checking behaviors on more stable measures of eating disorder pathology obtained before and after the 14-day EMI study period.

*Hypothesis 4:* After completing the 14-day EMI protocol, participants in both the NG-EMI and G-EMI groups will show significant reductions in more global and stable measures of eating disorder pathology, as indicated by changes between their pre- and post-test scores obtained before and after they completed the EMI portion of the study.

The control group will show no significant changes between pre- and post-test scores.

*Research Aim 5:* To investigate the feasibility and acceptance of a text-message EMI for self-monitoring among college women.

*Hypothesis 5a:* Participants in both EMI groups will demonstrate adequate study compliance by completing at least 70% of the momentary questionnaires during the 14-day EMI study period.

*Hypothesis 5b:* Participants will indicate overall acceptance of this technology-based intervention as measured by responses to the post-test qualitative questions assessing self-monitoring feasibility and accuracy.



## CHAPTER 2. METHOD

### Participants

Undergraduate female students were recruited from psychology courses at University of Hawaii. A total of 252 participants completed the initial online pre-screen (i.e., pre-test) questionnaires. Participant were invited via email to the remainder of the study if they self-reported high levels of body concern ( $BSQ > 109$ ) but *did not* self-report eating disorder pathology indicative of a probable clinically significant eating disorder (e.g., Cooper et al., 1987; Latner et al., 2013; Mond, Hay, Rodgers, & Owen, 2011). A total of 104 participants reported high body concern on their pre-screen questionnaire. Of these participants, 16 were identified as having a probable eating disorder and were excluded from the study after they were provided with appropriate resources and referral information. Of the 88 participants invited to the 14-day EMI portion of the study, a total of 69 participants provided informed consent to participate in the remainder of the study. Two of these participants dropped out within the first day of the study, resulting in a final  $n = 67$ . Participants were offered course credit for participating in the pre-screen and the EMI portion of the study.

The mean age of participants was 19.87 years ( $SD = 3.01$  years). A total of 25.4% ( $n = 17$ ) identified themselves as White, 25.4% ( $n = 17$ ) as East Asian, 23.9% ( $n = 16$ ) as Biracial or Multiracial, 17.9% ( $n = 12$ ) as Southeast Asian, 4.5% ( $n = 3$ ) as Native Hawaiian, and 3.0% ( $n = 2$ ) as Hispanic. Most participants were single (76.1%,  $n = 51$ ) and in their first year of college (47.8%,  $n = 32$ ).

### Pre-Post Test Measures

In order to examine potential changes in more stable eating and body-related constructs, global eating disorder pathology, body image concern, trait body image dissatisfaction, and

overall body checking and body avoidance behavior were assessed before and after the 14-day intervention period. Additionally, demographic variables and social desirability were assessed at pre-test.

### **Demographic Questionnaire**

The questionnaire assessed basic demographic information, current and ideal weight, and whether participants were previously or currently diagnosed with an eating disorder (Appendix A). Each participant's BMI was calculated from their reported height and weight using the following formula:  $BMI = \text{weight (lb.)} / [\text{height (in.)}]^2 \times 703$ .

### **Valence of Target Behaviors**

Participants were asked to report their beliefs about the valence of the eating and weight-related behaviors targeted for self-monitoring in the present study (Kazdin, 1974). Participants indicated their agreement with seven statements about the study's target behaviors, such as "*I believe it is a good thing to check my body shape and size in the mirror many times throughout the day*" and "*I believe it is a good thing to make decisions about what to eat based on how my body looks right at that moment,*" by responding to a 6-point Likert scale ranging from "*strongly disagree*" to "*strongly agree*" (Appendix A). Responses were averaged to create a total mean "behavior valence" score, which was included as a covariate in the final analyses. In the current study, internal consistency (i.e., Cronbach's alpha) of the 7-item measure was acceptable ( $\alpha = .73$ ).

### **Eating Disorder Symptomatology**

The Eating Disorders Examination - Questionnaire (EDE-Q; Fairburn & Beglin, 1994) is a 41-item self-report version of the Eating Disorder Examination interview (Appendix B). The EDE-Q measures core attitudinal eating-related psychopathology focusing on the past 28 days

and consists of four subscales: restraint, eating concern, shape concern, and weight concern, and a global score. Ratings are made on a seven-point Likert scale, with higher scores indicating a greater level of eating disturbance. The EDE-Q has shown good reliability and validity as a measure of eating disorder symptoms in both clinical and non-clinical populations (Berg, Peterson, Frazier, & Crow, 2011). Additionally, previous research has utilized the EDE-Q as a screening measure for probable cases of clinically significant eating disorders symptomatology within community and college populations (Latner et al., 2013; Mond et al., 2011; Stefano et al., 2016). In the current study, Cronbach's alphas for the Restraint, Eating Concern, Weight Concern, and Shape Concern subscales were  $\alpha = .79, .78, .80,$  and  $.81$ , respectively.

### **Body Shape-Related Perceptions and Behaviors**

The Body Shape Questionnaire (BSQ; Cooper, Taylor, Cooper, & Fairburn, 1987) is a 34-item self-report measure of trait body dissatisfaction and body trait preoccupations (Appendix C). Participants will be instructed to rate each question on a 6-point Likert scale, ranging from *never* to *always*. Scores range from 34 to 204 with higher scores indicating higher levels of body concern. The BSQ has demonstrated good test-retest reliability, concurrent and discriminant validity, and internal consistency in populations of college age women (Cooper et al., 1987; Rosen, Jones, Ramirez, & Waxman, 1996). In the present study, Cronbach's alpha for the BSQ was .89.

The Body Checking Questionnaire (BCQ; Reas, Whisenhunt, Netemeyer, & Williamson, 2002) is a 38-item self-report measure of overall body checking behavior frequency (Appendix D). Participants responded on a 5-point Likert-type scale, ranging from *never* to *very often* to indicate the frequency in which they engage in body checking behaviors at the present time. The BCQ measures the global construct of body checking behaviors as well as three sub-factors: 1)

the Overall Appearance Scale, which contains 10 items measuring checking behaviors related to overall appearance; 2) the Specific Body Parts Scale, which contains 8 items related to checking of specific body parts; and 3) the Idiosyncratic Checking Scale, which includes 5 items linked to “unusual” body checking behaviors, such as checking the diameter of the wrist or lying on the floor to feel if one’s bones touch the floor. Higher scores indicate greater frequency of body checking. The BCQ has shown good reliability and validity for use in both college age females and women with eating disorders (Calugi, Dalle Grave, Ghisi, & Sanavio, 2006; Reas et al., 2002). Cronbach’s alpha of the BCQ was excellent .90.

The Body Image Avoidance Questionnaire (BIAQ; Rosen, Srebnik, Saltzberg, & Wendt, 1991) is 19-item self-report questionnaire that measures behavioral avoidance of situations that trigger anxiety about physical appearance (Appendix E). Participants responded using a 6-point Likert scale ranging from *never* to *always* to indicate the frequency in which they engage in each behavior at the present time. High scores indicated greater frequency of body image avoidance. The BIAQ has demonstrated good psychometric properties as well as sensitivity to changes in body image avoidance following interventions for body-image disturbances (Rosen et al., 1991). In the current sample, Cronbach’s alpha of the BIAQ was .78.

### **Social Desirability**

The Marlowe-Crowne Social Desirability Scale – Version C Short Form (M-C Form C; Crowne & Marlowe, 1960; Reynolds, 1982) consists of 13 forced-choice true-false response items intended to measure the response bias of social desirability or “faking good” due to a need for approval or to respond in culturally sanctioned ways (Appendix F). The measure consists of “attribution items” whereby selecting “true” indicates a stronger tendency to respond in a socially desirable way (e.g. “I am always courteous, even to people who are disagreeable.”).

Additionally, the measure consists of “denial items” in which selecting “false” indicates a denial of socially disapproved but common behaviors (e.g. “I am sometimes irritated by people who ask favors of me.”). Higher scores indicate a greater level of social desirability or a greater likelihood of responding to self-report measures in a socially desirable way. The M-C Form C has demonstrated good reliability and validity properties (Loo & Thorpe, 2000; Reynolds, 1982) as a measure of social desirability independent from psychopathology. The M-C Form C was administered only during the pre-test portion of this study and was included as a covariate in the final analyses.

### **EMI Feasibility and Accuracy**

At the end of the EMI portion of the study, participants were asked to complete Likert-type and qualitative questions about the feasibility of the study demands as well as their perceived accuracy of their responses to the daily EMI questionnaires (Appendix G). Participants were asked to indicate how feasible it was to complete the daily questionnaires using a 7-point Likert scale ranging from *not at all feasible* to *very feasible*. Additionally, participants indicated their level of agreement to statements regarding the frequency of questionnaires, the duration of the EMI procedures, and their perceived level of reactivity after completing the questionnaires. Participants used a 7-point Likert scale that ranged from *strongly disagree* to *strongly agree*. Participants were also asked to provide an estimated percentage (ranging from 0-100%) of how accurate they believed their reported behavior frequencies were during the EMI portion of the study. Finally, participants were asked to provide their overall thoughts about the study in an open-ended prompt.

## EMI Measures

### Eating- and Weight-Related Thoughts and Behaviors

Participants were asked to self-monitor their eating- and weight-related thoughts and behaviors via a brief “EMI questionnaire” delivered five times a day for the 14-day EMI study period (Appendix H). These items were compiled based on disordered eating behavior checklists used in previous EMA and EMI studies (e.g., Heron, 2011; Smyth et al., 2007).

**Most recent eating episode.** At the beginning of each EMI questionnaire, participants indicated when they last ate or if they were currently eating when prompted. Participants were then asked to respond to five questions about their most recent eating episode(s) using a 5-point Likert scale ranging from *not at all* to *very much*. Participants indicated, when they last ate, to what extent did they: 1) try to limit the amount of food they ate; 2) have concern about other people seeing them eat; 3) eat an unusually large amount of food given the circumstances; 4) experience a loss of control over eating; and 5) try to follow eating-related rules. Cronbach’s alpha for the 5 items related to their most recent eating episode was .75.

**Disordered eating behavior.** Participants also indicated the frequency in which they engaged in four specific disordered eating-related behaviors (Appendix H). Participants were asked to record the number of times they 1) thought about their weight or body shape; 2) checked the calorie or nutrition content on a food label; 3) made a decision to eat or not to eat based on weight/shape; and 4) ate in response to a negative mood (emotional eating), since they were last contacted by the study. Additionally, participants indicated whether their recent weight-related thoughts were positive or negative using a 5-point Likert scale ranging from *very negative* to *very positive*.

**Body checking behavior.** Participants were asked to report the frequency they engaged in specific body checking behaviors by entering in the number of times they engaged in each behavior since they were last contacted (Appendix I). Seven of the most frequently reported body checking behaviors observed in a similar EMA study sample (Stefano et al., 2016) were chosen: (1) weighing oneself; (2) feeling body parts for fatness; (3) sucking in stomach; (4) feeling/pinching stomach to measure fatness; (5) comparing one's body to others (6) checking body size in a reflective surface; and (7) checking to see if thighs spread while sitting down.

### **State Negative Affect**

The Positive and Negative Affect Schedule – Expanded Form (PANAS-X; Watson & Clark, 1994) is a 60-item self-report inventory intended to measure various emotions (Appendix J). For the proposed study, the General Negative Affect, Guilt, and Sadness subscales will be used (a total of 19 items). The General Negative Affect subscale is composed of ten items that measure negative emotions and general distress. The Guilt subscale is composed of six items intended to measure guilt toward oneself, and the Sadness subscale consists of five items that measure an individual's sense of sadness and loneliness. Participants reported to what extent the listed emotions represented their current mood by responding on a 5-point Likert scale ranging from *very slightly or not at all* to *extremely*. Total scores represent the sum of subscale items with higher scores indicating a higher level of each affective state. The PANAS-X has demonstrated moderately high reliability and validity among non-clinical samples (Crawford & Henry, 2004; Watson, Clark, & Tellegen, 1988) and has been used as a repeated measure of state affect in a number of eating disorder-related EMA and diary studies (e.g., Arney, Crowther, & Miller, 2011; Leahey, Crowther, & Ciesla, 2011; Smyth et al., 2009). In the current sample, the

Cronbach's alphas for the General Negative Affect, Guilt, and Sadness subscales were .88, .91, and .92, respectively.

### **State Body Dissatisfaction**

The Body Image States Scale (BISS; Cash, Fleming, Alindogan, Steadman & Whitehead, 2002) is a 6-item self-report measure of state-dependent body dissatisfaction (Appendix K). Participants were asked to indicate how they feel “right now, at this very moment” about various aspects of their body image by selecting one of nine choices for each question, ranging from *extremely dissatisfied* to *extremely satisfied*. Lower scores on this measure indicated higher levels of body dissatisfaction. The BISS has demonstrated good reliability, internal consistency, and validity as a measure of state-dependent (as opposed to trait level) body dissatisfaction in non-clinical undergraduate women (Rudiger, Cash, Roehrig, & Thompson, 2007). Because of its focus on fluctuating state-dependent body evaluation, the BISS has been commonly used in ecological momentary studies (e.g., Colautti, Fuller-Tyszkiewicz, Skouteris, & Wyett, 2011; Leahey & Crowther, 2008; Rudiger et al., 2007). For the purpose of the present study, item 6 (“Right now I feel----than the average person”) was removed from the questionnaire because it may have further encouraged participants to engage in social comparison when responding to the prompt, which is a behavior this study's intervention was aimed to reduce. Internal consistency for both the 6-item and the 5-item BISS was examined from a previous dataset from a similar study (Stefano et al., 2016); both forms yielded similar and good levels of internal consistency ( $\alpha = .83$  and  $\alpha = .81$ , respectively). In the current sample, Cronbach's alpha for the 5-item BISS was .90.



### **Daily Text Message Intervention**

In addition to the EMI questionnaires, participants in the G-EMI group received a daily text message containing goal-directed and/or psychoeducational information related to the EMI target behaviors (Appendix L). The text message intervention was delivered to the G-EMI group once per day at a random time. The content of the daily text messages varied and included information about the effectiveness of self-monitoring unwanted or undesirable behaviors and psychoeducational information about related disordered eating constructs. The goal-directed and psychoeducational text messages were developed based on empirically validated treatment approaches (e.g., Fairburn, 2008), current findings in eating and weight-related research (e.g., Shafran, Lee, Payne, & Fairburn, 2007), and self-help modules for overcoming disordered eating produced by the Centre for Clinical Interventions (2008).

### **Manipulation Check**

A brief factual manipulation check (Kane & Barabas, 2019) was administered to G-EMI participants at post-test in order to examine participants' cognizance of the psychoeducational and goal-directed text messages they received during the 14-day EMI portion of the study (Appendix M). The manipulation check included five objective true/false questions about key information and content from the EMI intervention text messages (e.g., "Studies show that repeated body checking can increase the intensity of "feeling fat" and negative thoughts about one's weight and shape."). Participants responded either true or false to each item. A "correct" response to an item was scored as 1 point and an "incorrect" response was scored as 0 points for a maximum score of 5 points. The manipulation was considered successful if participants obtained a total score of 4 or greater.

## Procedure

### Pre-Screen

In order to participate in the study, participants were required to have access to a smartphone with Internet capabilities and be willing to use a small quantity of their cellular data in order to participate in the EMI portion of the study. After providing informed consent, participants completed the pre-test questionnaires (EDE-Q, BSQ, BCQ, BIAQ, and M-C Form C) online through the external survey website, Qualtrics.

Participants were screened for two characteristics before continuing to the EMI portion of the study: 1) high body concern and 2) the presence of a probable clinically significant eating disorder diagnosis. Participants who had high body concern but did *not* report symptoms consistent with a probable eating disorder diagnosis were asked to continue on in the study.

High body concern was indicated by a score of 109 or greater on the BSQ. This cutoff score was derived from the measure's original development and validation study (Cooper et al., 1987). The authors identified two groups of nonclinical women, a "concerned" group ( $n = 95$ ) that reported moderate to severe concern about weight and body shape and an "unconcerned group" ( $n = 79$ ) that endorsed little to no shape concern. The "concerned group" obtained a mean BSQ score of 109.00 ( $SD = 21.20$ ), and the mean score for the "unconcerned group" was 55.9 ( $SD = 14.40$ ) (Cooper et al., 1987). The cutoff score ( $BSQ > 109$ ) has been used in similar studies to identify individuals with moderate to severe body shape and weight concern (e.g., Reas et al., 2002; Stefano et al., 2016).

The presence of a probable clinically significant eating disorder was indicated by a series of cut off points on the EDE-Q (Hay, Marley, & Lemar, 1998; Mond et al., 2006). In order to be labeled as having probable clinically significant eating disorder symptomatology, participants

must score 5 or higher on both EDE-Q items assessing overevaluation of weight and shape *and* must have met at least one of the following criteria: during the past 28 days, at least weekly objective binge episodes (OBEs), subjective binge episodes (SBEs), self-induced vomiting, or laxative use, or at least 5 times weekly excessive (driven) exercise. Participants ( $n = 16$ ) who indicated clinically significant eating disorder symptomatology based on the cut off criteria were excluded from the remainder of the study (i.e., EMI protocol) and were referred to the Center for Cognitive Behavior Therapy – Eating Disorders Clinic at the University of Hawaii at Manoa, which provides free resources as well as outpatient assessment and treatment services to students and the community.

### **EMI Procedures**

Participants that met inclusion criteria were invited to participate in the remainder of the EMI study. After providing informed consent, participants were assigned to one of three study groups: the control group, the goal-directed EMI group (G-EMI group), or the non-directed EMI group that engaged in self-monitoring without any direction, explicitly stated goals, or psychoeducational information (NG-EMI group). See Figure 1 for depiction of the random assignment procedures.

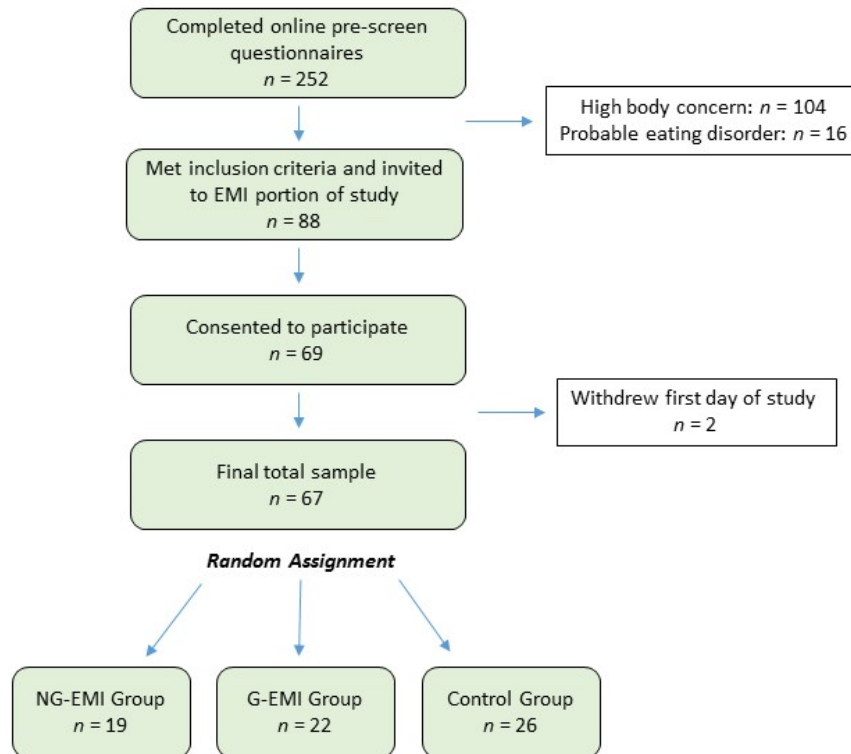


Figure 1. *Flow Chart of Random Assignment Procedures.*

Participants in the control group did not engage in any EMI procedures during the study. Two weeks after completing the pre-test questionnaires, participants in the control group were contacted via email to complete the post-test questionnaires (EDE-Q, BSQ, BCQ, and BIAQ).

Participants in both the G-EMI and NG-EMI groups were instructed to subscribe to Remind 101, an online text messaging system that does not require the researcher to use his or her personal cell phone number to contact the participants. Participants were instructed to watch a tutorial video fully explaining the EMI protocol in order to provide a more detailed and visual explanation of the study requirements. Additionally, the tutorial video provided examples and definitions of the target behaviors, which has been shown to increase accuracy and compliance during self-monitoring procedures (Korotitsch & Nelson-Gray, 1999). After watching the training video, participants in both EMI groups completed a “practice day” in order to become

familiar with the EMI procedures. During the practice day, participants were sent a practice questionnaire unrelated to eating and weight that was similar in length and question-type to the experimental questionnaire they received during the “active” EMI period of the study. Both groups received 5 text messages randomly throughout the day containing a link to the practice EMI questionnaire. All participants received feedback on their response rate via email at the end of the day. In the feedback email, participants were told the number of reminder texts they were sent (if any) and the number of questionnaires they missed (if any) during the practice day. Participants who completed at least 60% of the EMI prompts (3 out of 5) were asked to continue the study; all EMI participants ( $n = 41$ ) met the completion criteria for the practice day.

The remaining experimental EMI portion of the study took place over 14 consecutive days for both EMI groups. The chosen time period of 14 experimental days is modeled after similar effective EMI and EMA studies involving eating disorder assessment research (e.g., Crosby et al., 2008; Engel et al., 2005; Le Grange, Gorin, Dymek, & Stone, 2002). These studies yielded clinically and statistically significant results and behavior change after a 14-day EMA period and achieved compliance rates above 75%, suggesting the study demand and length was feasible for participants to complete.

In the present study, participants in both the G-EMI group and NG-GMI group were contacted 5 times per day via text messages sent to their cell phones during the 14-day EMI study. Each text message contained a hyperlink to the EMI questionnaire via Qualtrics, which included questions about their most recent eating and weight-related thoughts and behaviors, current body image dissatisfaction (BISS), and current negative affective states (PANAS). The text messages were sent randomly throughout the day between the hours of 9:00 AM and 10:00 PM. The selected times were constrained to at least 120 minutes apart throughout each day.

Randomly signaling participants to complete the questionnaire (as opposed to using predetermined times) provides two potential benefits: 1) It is unlikely that participants will be able to accurately predict when they will be contacted; and 2) Signal times will not systematically neglect any portion of the day (Smyth et al., 2001). Participants were asked to complete the questionnaire on their phones immediately after receiving the text message. Because participants may have been unable to immediately respond to a random signal (e.g., in class, driving a car), a follow-up reminder text message was sent if the questionnaire was not completed within 30 minutes of the initial text message. Existing EMA studies that used random signaling (i.e., 5-10 times per day) with follow-up reminders yielded response rates of 80-90% (e.g., Stefano et al., 2016; Smyth et al., 2001; Smyth et al., 1999), suggesting that participants are able to adequately respond to similar intensive EMA or EMI protocols.

During the 14-day EMI protocol, the NG-EMI group only received text messages containing a link to the EMI questionnaire, which prompted participants to report their most recent eating and weight-related thoughts and behaviors and they're state body dissatisfaction and negative affect. In addition to a text containing a link to the EMI questionnaire, participants in the G-EMI group were also sent the daily text message intervention, which contained goal-directed and/or psychoeducational information related to the target behaviors in the present study.

After completing the 14-day EMI protocol, participants in both EMI groups were asked to complete the post-test questionnaire via Qualtrics. Participants in the G-EMI group were asked to fill out an additional 5-item "manipulation check" measure that included brief true/false questions about the daily psychoeducational material they were sent throughout the EMI portion of the study (Appendix N). At the end of the study, all participants were sent a debriefing email

explaining the intent of the study. Due to the potentially upsetting nature of the content of this study and the use of a sample with high body concern, participants were provided with referral resources at the beginning and end of their participation in the study. Specifically, participants were provided with contact and descriptive information for the Center for CBT – Eating Disorders Program in Honolulu, Hawaii, which provides free psychotherapy services to students at the University of Hawaii and individuals in the community. Participants were also informed during the consent procedures that they may withdraw from the study at any point if they feel significant levels of distress or discomfort while participating.

### **Statistical Analyses**

#### **Preliminary Analyses**

Due to the number of analyses and comparisons included in this study, a significance level of  $\alpha = .01$  was used for all analyses. Descriptive analyses were conducted for the total study sample; baseline ranges, means, and standard deviations were calculated for the demographic variables and pre-test measures. One-way mixed analysis of variance (ANOVA) was used to examine potential baseline differences in demographic and pre-test variables between the three study groups.

Mean M-C Form C scores were calculated in order to determine if participants' responses to study measures were significantly influenced by social desirability bias. The correlation between social desirability score and the measure of interest is typically used to determine the extent to which social desirability bias contributed non-trait variance to the measure (Fisher & Katz, 2000). A significant correlation with a medium to large effect size would suggest that socially desirable responding has likely contaminated the variable of interest, and social desirability should then be appropriately controlled for in subsequent analyses (Paulhus, 1991).

Mean behavior valence score was calculated for the total sample and for each study group. While controlling for social desirability score, a series of partial correlations were computed to investigate the relationships between mean behavior valence and pre-test scores of body checking and avoidance behavior.

Finally, data collected during the EMI portion of the study were examined for overall compliance and completion rates for the NG-EMI and G-EMI groups. Additionally, aggregate descriptive analyses of the eating- and weight-related EMI data were conducted for the overall EMI sample and for each EMI study group (i.e., NG-EMI and G-EMI).

### **Multilevel Modeling**

Hierarchical Linear Modeling (HLM; Bryk & Raudenbush, 1992) was used to examine the EMI data within and between the G-EMI and NG-EMI groups for the first three hypotheses. HLM was appropriate for this type of longitudinal data as it takes into account the nested nature of the data (i.e., multiple data points or repeated assessment times nested within each individual participant). Rather than creating an aggregate sum for each variable across individuals, HLM retains the variability between individuals as well as the variability within each individual's repeated assessment time points. In other words, HLM examines whether variables within each individual (e.g., body dissatisfaction, negative affect) are related to between-person characteristics (e.g., frequency of body checking behavior). HLM is preferred over repeated measures ANOVA because it allows for missing data points, which commonly occurs when using EMA or EMI as a method of data collection as participants may not respond to every prompt or questionnaire (Heron & Smyth, 2010; Kuntsche & Labhart, 2013). HLM accounts for this missing data and does not require statistical replacement of missing values. In the current



study, Level 2 was the participant ( $n = 41$ ), and Level 1 was the multiple assessment times within the participant ( $n = 2366$  time points).

### **Hypothesis 1**

HLM was used to determine if higher frequency of disordered eating behaviors and body checking behaviors predicted the concurrent presence of higher state body dissatisfaction and negative affect for individuals in both the G-EMI and NG-EMI groups. In an effort to condense the required number of analyses, several aggregate variables were created. Responses to the five items about the participant's most recent eating episode were averaged to create a total "EAT" score, in which a higher score represented greater eating-related pathology or concern. Next, the reported instances of the four disordered eating behaviors at each time point were aggregated into a single disordered eating frequency variable ("ED frequency"), and the seven body checking behaviors were aggregated to create a single body checking frequency variable ("BC frequency"). The final model for this analysis included ED frequency and BC frequency as Level 1 predictors with state body dissatisfaction (BISS) and state negative affect (PANAS General Negative Affect, Guilt, and Sadness subscales) as four separate outcome variables.

### **Hypothesis 2**

HLM was also used to examine changes in frequency of disordered eating and body checking behaviors over time during the 14-day EMI portion of the study. The aggregated ED frequency and BC frequency variables created for Hypothesis 1 were used as outcome variables and assessment time in study (e.g., 1 to 70) was included as a Level 1 predictor in the final models used to test Hypothesis 2.

### **Hypothesis 3**

Similar to Hypothesis 2, ED frequency and BC frequency were outcome variables and assessment time in study was included as a Level 1 predictor. However, separate models were run for each study group (i.e., NG-EMI and G-EMI groups) in order to examine the magnitude of change in the outcome variables over time specific to each study group. Therefore, a total of four separate models were run to test Hypothesis 3. One-tailed t-tests were conducted to test for statistically significant differences between standardized coefficients of the NG-EMI and G-EMI study groups.

### **Hypothesis 4**

After determining there were no statistically significant differences between study groups at baseline, paired sample t-tests were conducted to compare pre- and post-test scores within each study group (NG-EMI, G-EMI, and the control group). Specifically, mean changes in pre- and post-test scores within each group were examined for the following variables: body shape concern (BSQ), global eating disorder pathology (EDE-Q), baseline body checking behaviors (BCQ), and body avoidance behaviors (BIAQ).

### **Hypothesis 5a**

Compliance and completion data were examined each group in order to determine overall adherence to the two-week EMI protocol. For each participant in the EMI groups, completion percentages were calculated by dividing the number of completed EMI surveys by the total number of EMI surveys distributed. A mean completion percentage was calculated for both the G-EMI and NG-EMI groups, and a chi-square test was conducted to determine if there was a significant difference in questionnaire completion rates between the two groups. Based on

existing EMA and EMI research, a mean completion percentage of 70% or greater indicated adequate compliance in the present study (Smyth et al., 2001).

### **Hypothesis 5b**

In order to evaluate Hypothesis 5b, participants' responses to the post-test feasibility and accuracy Likert-type questions were averaged and examined. Additionally, participants' qualitative responses and feedback to the open-ended prompt at post-test were examined for common themes and attitudes towards the EMI procedures, text message intervention, and overall study procedures.

## CHAPTER 3. RESULTS

### Sample Description

See Table 1 for descriptive information and mean pre-test scores for the total sample ( $n = 67$ ). The final sample of 67 women obtained a mean BSQ score of 144.87 ( $SD = 22.37$ ) and a mean BMI of 26.15 ( $SD = 5.86$ ;  $Mdn = 24.45$ ). In the original development and validation study of the BSQ, nonclinical women identified as having moderate to severe concern about weight and shape obtained a mean BSQ score of 109.00 (Cooper et al., 1987).

Additionally, the total sample in the present study reported elevated levels of baseline body checking behavior as indicated by their pre-test BCQ total and sub-factor scores, which were similar to existing norms observed in women with very high body concern and clinical eating disorder populations (Mountford, Haase, & Waller, 2006; Reas et al., 2002).

Although participants were screened out of the present study if they self-reported or were identified as having a probable eating disorder, the EDE-Q global and subscale scores of the final sample still fell within the 70<sup>th</sup> to 90<sup>th</sup> percentile range for EDE-Q scores observed in a sample of 5,255 young adult women (Mond et al., 2006), suggesting the presence of notable eating disorder pathology compared to the general female population.

Participants were also asked about their past and current dieting behavior. A total of 70.1% ( $n = 47$ ) endorsed a history of dieting in order to lose weight, and 29.9% ( $n = 20$ ) reported they were currently dieting to lose weight at the time of the study. The majority of participants considered themselves to be overweight (55.2%), and the remaining participants considered themselves to be normal weight (31.3%), obese (11.9%), or underweight (1.5%). Based on participants' self-reported current and ideal body weights, results suggested participants would

ideally like to have weighed an average of 23.09 lbs ( $SD = 21.39$  lbs; range = 0 to 100 lbs) less than what they currently weighed at the time of the study.

Based on these descriptive statistics, the overall sample used in the present study can be characterized as women who are, on average, normal weight to slightly overweight (normal weight BMI = 18.5-24.9) with very high body concern, body dissatisfaction, subclinical eating disorder pathology, and elevated baseline body checking behavior.

Table 1. *Descriptive Statistics and Mean Pre-Test Scores for Total Study Sample (n = 67)*

	Min	Max	<i>M</i>	<i>SD</i>
Age	18	39	19.87	3.01
BMI	17.36	47.82	26.15	5.86
BSQ Total	111.00	200.00	144.87	22.37
EDE-Q Global	0.86	4.77	2.69	0.84
EDE-Q Restraint	0.00	5.00	1.87	1.34
EDE-Q Eating Concern	0.00	4.80	1.54	1.24
EDE-Q Shape Concern	1.86	5.29	3.62	0.79
EDE-Q Weight Concern	0.80	5.00	3.62	0.79
BCQ Total	34.00	112.00	72.19	16.74
BCQ Overall Appearance	18.00	49.00	33.82	7.51
BCQ Specific Body Parts	10.00	40.00	26.31	7.14
BCQ Idiosyncratic Checking	5.00	23.00	12.07	4.43
BIAQ Total	13.00	69.00		
M-C Form C	0.00	13.00	5.69	2.72
Behavior Valence	1.29	5.43	3.40	0.87

## Study Groups

After completing the pre-test (i.e., pre-screen) questionnaires, participants were randomly assigned to one of three groups: NG-EMI ( $n = 19$ ), G-EMI ( $n = 22$ ), or the control group ( $n = 25$ ). There were no statistically significant differences between groups for age ( $F(2,65) = 0.39, p = .68$ ), BMI ( $F(2,65) = 1.11, p = .33$ ), social desirability score ( $F(2,65) = 0.36, p = .70$ ), target behavior valence ( $F(2,65) = 0.69, p = .16$ ), or degree of weight and shape concern as measured by the BSQ ( $F(2,65) = 0.64, p = .53$ ).

### **Social Desirability**

Scores on the M-C Form C ranged from 0 to 13 with higher scores suggested a tendency to respond to questions in a socially desirable way. The total study sample ( $n = 67$ ), obtained a mean M-C Form C score of 5.69 ( $SD = 2.72$ ), which is similar to norms found in other college age samples (e.g., Loo & Loewen, 2004; Loo & Thorpe, 2000). Pearson correlation coefficients were computed to investigate potential relationships between social desirability score and total sample pre-test scores, including the BSQ, BCQ total and subscales, and EDE-Q and subscales. M-C Form C score was significantly associated with BCQ total score ( $r = -.31, p = .01$ ) and BIAQ total score ( $r = -.32, p = .008$ ). These moderate effect sizes suggest social desirability explained 9.61% and 10.24% of the shared variance in BCQ total score and BIAQ total score, respectively. Therefore, social desirability was controlled for in all relevant analyses in the present study.

### **Valence of Target Behaviors**

Responses to the 7-item measure of behavior valence were averaged for the total sample to yield a mean score of 3.40 ( $SD = 0.87$ ). There were no statistically significant differences between groups for behavior valence score. Behavior valence score was significantly associated with BCQ total pre-test score ( $r = .33, p < .01$ ) and BCQ Idiosyncratic Checking Scale pre-test score ( $r = .35, p < .01$ ), but not with body avoidance as measured by the BIAQ ( $r = .27, p = .03$ ). These findings suggest participants who reported a positive valence towards the targeted self-monitoring behaviors (i.e., considered them “desirable” behaviors) also reported engaging in significantly greater levels of baseline body checking at pre-test.

### **Manipulation Check**

The manipulation check items were summed to yield a total score for each participant in the G-EMI group. The “correct” answer to each question was scored as 1 point and the “incorrect” answer was scored as 0 for a total possible score of 5 points. All participants in the G-EMI group scored a total of at least 4 ( $n = 7$ ) or 5 ( $n = 15$ ) points, suggesting participants in the G-EMI group adequately perceived, interpreted, and reacted to the text message intervention component (Hoewe, 2017).

### **EMI Compliance**

Across all participants in the NG-EMI and G-EMI groups ( $n = 41$ ), a total of 2,870 survey text messages were sent. The overall compliance rate during the 14-day EMI protocol was 82.4%. Compliance rates for the NG-EMI and G-EMI groups were 75.6% and 88.4%, respectively. A chi-square test indicated compliance rates were statistically different between groups,  $\chi^2(1, N = 2870) = 80.93, p < .001$ , such that compliance was significantly greater among participants in the G-EMI group compared to the NG-EMI group.

Participants took an average of 3 minutes and 16 seconds ( $SD = 1$  minute and 11 seconds) to complete the EMI questionnaire from beginning to end. A total of 602 reminder text messages were sent after participants did not respond within 30 minutes of the initial text message prompt. A reminder text message was sent for a total of 21% of the overall assessment times. Upon receiving a reminder text, participants were successfully prompted to complete their current questionnaire at a rate of 52%.

Weekdays had an overall response rate of 82.7%, and weekend days had an overall response rate of 82.1%. A chi-square test indicated compliance rates were not statistically different between weekdays and weekend days,  $\chi^2(1, N = 2870) = 0.16, p = .69$ .

## Aggregate and Descriptive Analyses

### Most Recent Eating Episode

For the total EMI sample ( $n = 41$ ), mean scores were calculated for each of the five descriptive questions related to participants' most recent eating episode on the EMI questionnaire (Table 2). Descriptive findings suggested, on average, participants frequently tried to limit the amount of food they ate and often felt concerned about other people seeing them eat during their most recent eating episode. Results also suggested participants did not typically endorse eating an unusually large amount of food or experiencing a loss of control over eating. However, participants responded feeling "quite a bit" or "very much" afraid of losing control over their eating for 45.7% of the total responses, suggesting a considerable portion of the sample potentially experienced binge eating symptoms or behaviors throughout the 14-day self-monitoring period.

Table 2. *Mean Responses to Most Recent Eating Episode Descriptive Questions for Total EMI Sample ( $n = 41$ )*

<i>When you most recently ate, how much...</i>	<i>M</i>	<i>SD</i>
...did you try to limit the amount of food you ate?	4.08	1.18
...were you concerned about others seeing you eat?	3.60	1.42
...did you eat an unusually large amount of food?	2.01	1.56
...were you afraid of losing control over your eating?	1.93	1.49
...did you try to follow rules regarding your eating?	3.33	1.71

### Disordered Eating Behaviors

Of the four specific eating-related behaviors assessed in this study (i.e., thought about weight and shape, checked a food label, made a decision to eat or not to eat based on shape/weight, and ate in response to a negative emotion), the overall sample reported a total of 10,184 disordered eating behaviors during the 14-day study. See Table 3 for an aggregate breakdown of behavior type for the overall sample and by EMI group.



The most commonly reported behavior for both EMI groups was thinking about one's weight and shape. On average, all participants indicated their recent weight- and shape-related thoughts were negative ( $M = 1.77$ ,  $SD = 0.96$ ). Further, the NG-EMI group ( $M = 1.70$ ,  $SD = 0.84$ ) rated their weight-related thoughts as significantly more negative than the G-EMI group ( $M = 1.87$ ,  $SD = 1.10$ );  $t(1802) = 3.98$ ,  $p < .001$ .

The reported frequencies of the remaining three eating-related behaviors appeared to differ between the two study groups. The G-EMI group reported similar frequencies of each behavior, while the NG-EMI group appeared to have more variability, with the most frequently reported behavior as making a decision to eat or not to eat based on body shape. Additionally, despite the slightly different group sample sizes, the NG-EMI group reported eating in response to a negative mood (i.e., emotional eating) notably less often compared to the G-EMI group.

Table 3. *Aggregate Breakdown of Reported Eating Disorder Behavior Frequencies for Total Sample and by EMI Group*

Disordered Eating Behavior	Overall Reported Frequency	NG-EMI $n = 19$	G-EMI $n = 22$
Thought about weight and shape	6693	3309	3384
Checked food label	1174	482	692
Made decision based on body shape	1337	683	654
Ate in response to negative mood	980	318	662

### Body Checking Behaviors

Results indicated that 100% of participants reported engaging in at least one instance of body checking during the 14-day EMI protocol. After aggregation of both groups, the total number of body checking behaviors reported over the course of the study per participant ranged from 87 to 1,014 ( $M = 586.05$ ,  $SD = 189.90$ ). Participants reported a range of 0 to 149 body checking behaviors per day ( $M = 42.86$ ,  $SD = 23.66$ ) and a range of 0 to 50 body checking behaviors per assessment time ( $M = 10.16$ ,  $SD = 6.47$ ).

A total 24,028 body checking behaviors were reported by the overall sample during the 14-day study. See Table 4 for an aggregate breakdown of body checking behavior type for the overall sample and by EMI group. The most frequently reported body checking behaviors for both EMI groups were comparing one's body to others, checking one's body in a reflective surface, and sucking in one's stomach. The least frequently reported body checking behavior was weighing oneself. However, 85.4% ( $n = 35$ ) participants reported weighing themselves more than once per day at least one time during the 14-day study. Overall, participants reported weighing themselves between 0 to 9 times per day and a median of 1 time per day ( $M = 1.6$ ,  $SD = 1.43$ ).

Table 4. *Aggregate Breakdown of Reported Body Checking Behavior Frequencies for Total Sample and by EMI Group*

Body Checking Behavior	Overall Reported Frequency	NG-EMI $n = 19$	G-EMI $n = 22$
Weighed self	918	337	581
Felt body parts for fatness	3453	1310	2143
Sucked in stomach	4368	1872	2496
Felt/pinched stomach	3795	1537	2258
Compared body to others	4680	2362	2318
Checked body in reflective surface	4618	2257	2361
Checked for thighs spreading	2196	912	1284

### Multilevel Analyses

#### Missing Data

Ecological momentary assessment and intervention typically results in some missing data as participants may not respond to every assessment occasion. HLM accounts for missing data at Level 1, but not Level 2, and it does not require any replacement of missing values under the condition that the data is missing at random. A total of 17.6% of Level 1 data were missing due to participants' non-responding. There were no missing data at Level 2.

## Outliers and Assumptions

Before analyses, outliers were checked using bivariate correlation charts for each variable pairing (i.e., the predictor and the outcome variable pairing). After visual inspection of the correlation charts for each predictor and outcome pairing, a total of 17 data points were removed as outliers (0.72% of non-missing data). Assumptions were examined for each final model in the present study, including linearity, normality of distribution, homoscedasticity of Level 1 predictors, multivariate normality of the random effects, and homogeneity of Level 1 and 2 residuals. Assumptions were met for all final models.

## Intraclass Correlation Coefficient

To ensure the data were appropriate for HLM, the Intraclass Correlation Coefficient (ICC) was calculated from the null model for each outcome variable. The ICC is used to describe the amount of variability between and within participants, or the proportion of variance between groups (i.e., individuals). The ICC can be interpreted as the proportion of variance in the outcome variable that can be accounted for by the Level 2 predictors (Hox, 2010). A high ICC indicates greater homogeneity *within* groups and greater heterogeneity *between* groups, which would indicate the need for a multilevel analysis or HLM. For each multilevel model, the ICC was calculated from the associated null model using the following formula:

$$\rho = \frac{\tau}{(\tau + \sigma^2)}$$

In this formula,  $\tau$  is the between-cluster variance at Level 2 (i.e., variance between participants) and  $\sigma^2$  is the within-cluster variance at Level 1 (i.e., variance within each individual's assessment times). Bryk and Raudenbush (1992) strongly recommend using HLM when the ICC is greater than 0.10, which indicates at least 10% of the total variability in the model is related to between group (i.e., participant) differences.

## Final Models

Measurement time and participant (i.e., the individual) were considered random factors within all final multilevel models of the present study. Including time and participant as random factors was chosen after comparing log likelihoods for alternative models with measurement time as 1) a random factor or 2) a repeated factor. For each model, the difference in parameters was compared to a critical chi-square value ( $p < .05$ ) for the difference in degrees of freedom ( $df$ ). For example, if the difference in log likelihoods was 45.23 in model 1 ( $df = 6$ ) and model 2 ( $df = 4$ ), then the critical chi-square difference would be  $\chi^2(2) = 5.99$ , indicating that the models were significantly different. If both log likelihood models are significantly different than the chi-square cut off value, then the smaller log likelihood model should be chosen, because smaller likelihood values indicate a better fitting model. Log likelihood comparisons were conducted in this manner for each final model in the present study (i.e., separate models were run for each outcome variable), and analyses indicated it was most appropriate to include measurement time and participant as random factors within all final models.

## Hypothesis 1

*H1: For all participants engaging in self-monitoring (i.e., NG-EMI and G-EMI groups), higher reported frequency of disordered eating behavior and body checking behavior will predict the concurrent presence of higher levels of state body dissatisfaction and state negative affect.*

Separate models were run for each of the five outcome variables (i.e., EAT, BISS, and three PANAS subscales). Level 2 consisted of 41 individuals (i.e., clusters) across both EMI groups, and Level 1 consisted of a total of 2,366 time points across all individuals. The null models for EAT and BISS yielded an ICC of 0.28 and 0.53, respectively, indicating

approximately 28% and 53%, respectively, of the total variability in the outcome variables was related to between group (i.e., between individual participants) differences. With the PANAS General Negative Affect, Guilt, and Sadness subscales included as outcome variables, the data for each model yielded an ICC of 0.71, 0.52, and 0.58, respectively.

In the final models, disordered eating behavior frequency (ED frequency) and body checking frequency (BC frequency) at each assessment time point were included as Level 1 predictors. Social desirability score (i.e., M-C Form C) and mean behavior valence score, which were obtained at pre-test, were controlled for as Level 2 covariates within each model. Level 1 variables were centered around the group mean. Group-mean centering is most appropriate when a Level 1 predictor (i.e., BC frequency or ED frequency) is of substantive interest; group-mean centering removes all between-cluster variation from the predictor(s) and yields a purer estimate of the pooled within-group (i.e., Level 1) regression coefficients (Raudenbush & Bryk, 2002). Level 2 variables were centered around the grand mean.

#### **Level-1 Model**

$$Y_{ij} = \pi_{0i} + \pi_{1i}*(ED\_TOTAL_{ti}) + \pi_{2i}*(BC\_TOTAL_{ti}) + e_{ii}$$

#### **Level-2 Model**

$$\pi_{0i} = \beta_{00} + \beta_{01}*(VALENCE_i) + \beta_{02}*(RFC\_SUM0_i) + r_{0i}$$

$$\pi_{1i} = \beta_{10}$$

$$\pi_{2i} = \beta_{20} + r_{2i}$$

#### **Mixed Model**

$$Y_{ij} = \beta_{00} + \beta_{01}*VALENCE_i + \beta_{02}*RFC\_SUM0_i + \beta_{10}*ED\_TOTAL_{ti} + \beta_{20}*BC\_TOTAL_{ti} + r_{0i} + r_{2i}*BC\_TOTAL_{ti} + e_{ii}$$

Analyses revealed that for the total EMI sample ED frequency, but not BC frequency, was a significant predictor of EAT score, such that higher frequency of disordered eating behaviors predicted the presence of greater eating disorder pathology or eating-related concerns during the participant's most recent meal. ED frequency and BC frequency were both significant predictors of BISS score, such that higher frequency of disordered eating and body checking behavior predicted the concurrent presence of greater state body dissatisfaction. ED frequency and BC frequency were also both significant positive predictors of the PANAS General Negative Affect and Guilt subscales. For the PANAS Sadness subscale, only BC frequency was a significant predictor. See Table 5 for results for each model. Overall, results indicated higher frequency of momentary disordered eating and body checking behaviors predicted greater state body dissatisfaction and negative affect.

Table 5. *Disordered Eating Frequency and Body Checking Behavior Frequency as Predictors of Eating Pathology at Last Meal, State Body Dissatisfaction, Negative Affect for all EMI Participants*

Outcome variable	Predictor	$\beta$	SE	t	p
EAT	ED Frequency	0.19	0.01	13.97	<.001
	BC Frequency	-0.02	0.01	-0.28	.78
BISS	ED Frequency	-0.07	0.01	-7.39	< .001
	BC Frequency	-0.11	0.02	-6.42	< .001
PANAS Gen Neg Affect	ED Frequency	0.10	0.03	3.84	< .001
	BC Frequency	0.12	0.02	7.09	< .001
PANAS Guilt	ED Frequency	0.18	0.04	4.99	< .001
	BC Frequency	0.12	0.02	5.63	< .001
PANAS Sadness	ED Frequency	0.03	0.02	1.92	.06
	BC Frequency	0.03	0.01	3.10	.004

The addition of ED and BC frequency as predictors resulted in a change in residual variance at both Level 1 and Level 2 for each outcome variable (See Table 6). Change in Level 1 residual variance was calculated using the formula  $\sigma^2_{explained} = (\sigma^2_{null} - \sigma^2_{conditioned}) / \sigma^2_{null}$  and change in Level 2 residual variance was calculated using the formula  $\tau_{explained} = (\tau_{null} - \tau$

conditioned). /  $\tau_{\text{null}}$ . For all outcome variables, the addition of the Level 1 predictors (ED and BC frequency) caused Level 2 residual variance to decrease from the null model, indicating the addition of the predictors allowed for a better conditional model. Change in residual variance from the null model to the full model can be interpreted as a proportion or percentage of change in variance explained. For example, with respect to the BISS model, the addition of ED and BC frequency as Level 1 predictors explained an additional 25.49% of residual variance in state body dissatisfaction between times within the individuals and an additional 5.26% of residual variance between individuals. Change in variance explained at Level 1 was greatest for the BISS model, suggesting ED and BC frequency were better predictors of state body dissatisfaction than negative affect across assessment times within the same individual (i.e., Level 1).

Table 6. *Variance Explained at Level 1 and Level 2 for Outcome Variables with ED and BC Frequency Included as Predictors*

Outcome Variable	Null Model	Full Model	Variance Explained
EAT	$\sigma^2 = 0.75$ $\tau = 0.29$	$\sigma^2 = 0.56$ $\tau = 0.29$	25.33% 0%
BISS	$\sigma^2 = 1.02$ $\tau = 1.20$	$\sigma^2 = 0.76$ $\tau = 1.14$	25.49% 5.26%
PANAS Gen Negative Affect	$\sigma^2 = 7.36$ $\tau = 19.30$	$\sigma^2 = 6.12$ $\tau = 18.42$	16.85% 4.56%
PANAS Guilt	$\sigma^2 = 6.52$ $\tau = 6.14$	$\sigma^2 = 5.50$ $\tau = 6.03$	15.64% 1.79%
PANAS Sadness	$\sigma^2 = 2.96$ $\tau = 2.17$	$\sigma^2 = 2.86$ $\tau = 2.10$	3.36% 3.23%

## Hypothesis 2

H2: *During the 14-day EMI protocol, all participants who engage in self-monitoring (i.e., participants in the NG-EMI and G-EMI study groups) will show a significant reduction over time*

*in the frequency of disordered eating and body checking behaviors reported on the EMI questionnaires.*

To test Hypothesis 2, separate models were run for each of the two outcome variables: ED frequency and BC frequency. Null models for each outcome variable yielded an ICC of 0.67 and 0.85, respectively. The final models included length of time in study or study assessment time (range 1 to 70) as a Level 1 predictor. Social desirability and behavior valence score were also controlled for as Level 2 covariates.

#### **Level-1 Model**

$$ED\_TOTAL_{ti} = \pi_{0i} + \pi_{1i}*(STUDYTIM_{ti}) + e_{ti}$$

#### **Level-2 Model**

$$\pi_{0i} = \beta_{00} + r_{0i}$$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

#### **Final Mixed Model**

$$ED\_TOTAL_{ti} = \beta_{00} + \beta_{10}*STUDYTIM_{ti} + r_{0i} + r_{1i}*STUDYTIM_{ti} + e_{ti}$$

Analyses revealed that, while controlling for social desirability and behavior valence, length of time in the study significantly predicted ED frequency in that the total EMI sample reported engaging in fewer disordered eating behaviors over the 14-days self-monitoring period,  $\beta = -0.04$ ,  $t(38) = -8.71$ ,  $p < .001$ . Time in study was also a significant predictor of BC frequency, such that EMI participants' self-reported body checking behavior significantly reduced over time throughout the study period,  $\beta = -0.13$ ,  $t(38) = -13.90$ ,  $p < .001$ . See Table 7 for changes in residual variance explained at Level 1 and Level 2 for each model.



Table 7. *Variance explained at Level 1 and Level 2 for Outcome Variables with Time in Study Included as a Predictor*

Outcome Variable	Null Model	Full Model	Variance Explained
ED Frequency	$\sigma^2 = 6.61$ $\tau = 3.91$	$\sigma^2 = 5.67$ $\tau = 3.20$	14.22% 18.16%
BC Frequency	$\sigma^2 = 35.90$ $\tau = 7.88$	$\sigma^2 = 27.31$ $\tau = 6.51$	23.93% 17.39%

*Note.* ED Frequency = Disordered eating behavior frequency; BC Frequency = Body checking behavior frequency.

### Hypothesis 3

H3: *Participants in the G-EMI group will show significantly greater reduction in self-reported frequency of disordered eating and body checking behaviors over the 14-day EMI study period compared to the NG-EMI group.*

The analyses for Hypothesis 3 included a similar design and model to that of Hypothesis 2: Separate models were run with ED frequency and BC frequency as outcome variables, and length of time in study was included as a Level 1 predictor. However, the two models were run separately for the NG-EMI group and the G-EMI group in order to examine the magnitude of change in the outcome variables specific to each study group. Therefore, a total of four models were examined. Social desirability and behavior valence were controlled for as Level 2 covariates in all final models. With ED frequency as the outcome variable, the NG-EMI and G-EMI models had an ICC of 0.39 and 0.62, respectively. With BC frequency as the outcome variable, the NG-EMI and G-EMI models had an ICC of 0.21 and 0.46, respectively.

Findings suggested BC frequency significantly reduced over time for both the G-EMI group,  $\beta = -0.29$ ,  $t(21) = -16.21$ ,  $p < .001$  and the NG-EMI group,  $\beta = -0.11$ ,  $t(18) = -7.23$ ,  $p < .001$ , and body checking in the G-EMI group reduced at a significantly faster rate than the NG-EMI group,  $t(39) = 19.49$ ,  $p < .001$ . ED frequency also significantly reduced over time for both the G-EMI group,  $\beta = -0.04$ ,  $t(21) = -19.76$ ,  $p < .001$ , and the NG-EMI group,  $\beta = -0.04$ ,  $t(18) = -$

4.46,  $p < .001$ , but there was no significant difference in rate of change between groups,  $t(39) = 0.77$ ,  $p = .22$ .

#### **Hypothesis 4**

*H4: After completing the 14-day EMI protocol, participants in both the NG-EMI and G-EMI groups will show significant reductions in more global and stable measures of eating disorder pathology, as indicated by changes between their pre- and post-test scores obtained before and after they completed the EMI portion of the study. The control group will show no significant changes between pre- and post-test scores.*

A series of one-way ANOVA's indicated there were no significant differences between the three study groups (i.e., NG-EMI, G-EMI, and control group) on all pre-test measures of eating disorder pathology (Table 8).

*Table 8. One-Way ANOVA Results for Comparison of Pre-Test Scores by Study Group*

	<i>F</i> (2,63)	<i>p</i>
BSQ Total	0.64	.53
EDE-Q Global	2.04	.61
EDE-Q Restraint	1.34	.27
EDE-Q Eating Concern	0.14	.87
EDE-Q Shape Concern	2.96	.06
EDE-Q Weight Concern	2.96	.06
BCQ Total	2.19	.12
BCQ Overall Appearance	0.98	.38
BCQ Specific Body Parts	2.56	.09
BCQ Idiosyncratic Checking	2.02	.14
BIAQ Total	0.46	.63

Paired sample t-tests were conducted to examine mean changes in pre- and post-test scores within each study group. Specifically, within each study group, pre- and post-test scores were compared for the BSQ, the EDE-Q Global and subscale scores, the BCQ total and subscale scores, and the BIAQ. See Table 9 for mean pre-test and post-test scores and t-test statistics for each group.

For the NG-EMI group, results indicated that mean BCQ Overall Appearance was significantly lower at post-test ( $M = 33.05$ ,  $SD = 7.55$ ) compared to pre-test ( $M = 33.84$ ,  $SD = 7.36$ ),  $t(18) = 3.44$ ,  $p = .003$ . These findings suggested participants reported engaging in an overall greater level of appearance-related body checking at post-test compared to their reported body checking behavior at pre-test. No other significant differences were found between pre- and post-test scores for the NG-EMI group.

For the G-EMI group, post-test scores were significantly lower than pre-test scores on two measures of eating disorder pathology: the EDE-Q Global score [ $t(21) = 3.00$ ,  $p = .007$ ] and the EDE-Q Weight Concern subscale [ $t(21) = 6.54$ ,  $p < .001$ ]. Additionally, participants reported significantly lower post-test scores on their overall level of body checking behavior as indicated by significant changes in the BCQ total score [ $t(21) = 5.03$ ,  $p < .001$ ], the BCQ Overall Appearance subscale [ $t(21) = 5.03$ ,  $p < .001$ ], and the BCQ Specific Body Parts subscale [ $t(21) = 3.19$ ,  $p = .004$ ]. There were no significant differences between pre- and post-test scores for the control group.

Table 9. Mean Pre- and Post-Test Scores and T-Test Statistics for Each Study Group

	Pre-Test <i>M</i> ( <i>SD</i> )	Post-Test <i>M</i> ( <i>SD</i> )	<i>t</i>	<i>p</i>
<b>NG-EMI Group (<i>n</i> = 19)</b>				
BSQ Total	144.00 (26.69)	143.32 (23.42)	0.53	.60
EDE-Q Global	2.50 (0.93)	2.60 (1.18)	-0.60	.57
EDE-Q Restraint	1.47 (1.09)	1.84 (1.44)	-1.52	.15
EDE-Q Eating Concern	1.47 (1.37)	1.65 (1.30)	-0.72	.48
EDE-Q Shape Concern	3.44 (0.98)	3.47 (1.03)	-0.14	.89
EDE-Q Weight Concern	3.60 (1.22)	3.44 (1.58)	0.87	.40
BCQ Total	71.63 (18.05)	68.21 (18.54)	2.54	.02
<b>BCQ Overall Appearance</b>	<b>33.05 (7.55)</b>	<b>30.84 (7.36)</b>	<b>3.44</b>	<b>.003</b>
BCQ Specific Body Parts	26.53 (7.18)	25.05 (7.39)	2.16	.04
BCQ Idiosyncratic Checking	12.05 (5.53)	12.32 (5.51)	-0.50	.62
BIAQ Total	39.89 (14.66)	39.58 (14.56)	0.17	.87
<b>G-EMI Group (<i>n</i> = 22)</b>				
BSQ Total	149.41 (20.26)	146.09 (14.98)	2.07	.05
<b>EDE-Q Global</b>	<b>2.93 (0.82)</b>	<b>2.83 (0.75)</b>	<b>3.00</b>	<b>.007</b>
EDE-Q Restraint	1.95 (1.45)	1.91 (1.45)	0.96	.35
EDE-Q Eating Concern	1.67 (1.35)	1.66 (1.28)	0.11	.91
EDE-Q Shape Concern	3.95 (0.60)	3.94 (0.50)	0.25	.81
<b>EDE-Q Weight Concern</b>	<b>4.15 (0.74)</b>	<b>3.83 (0.77)</b>	<b>6.54</b>	<b>&lt;.001</b>
<b>BCQ Total</b>	<b>78.05 (15.40)</b>	<b>71.95 (12.11)</b>	<b>5.03</b>	<b>&lt;.001</b>
<b>BCQ Overall Appearance</b>	<b>35.77 (8.22)</b>	<b>32.45 (6.43)</b>	<b>5.03</b>	<b>&lt;.001</b>
<b>BCQ Specific Body Parts</b>	<b>28.82 (6.57)</b>	<b>26.18 (4.29)</b>	<b>3.19</b>	<b>.004</b>
BCQ Idiosyncratic Checking	13.50 (3.78)	13.32 (3.27)	0.56	.58
BIAQ Total	39.73 (11.93)	38.59 (9.07)	1.27	.22
<b>Control Group (<i>n</i> = 26)</b>				
BSQ Total	141.65 (20.82)	144.31 (20.05)	-1.31	.20
EDE-Q Global	2.64 (0.77)	2.81 (0.73)	-1.95	.06
EDE-Q Restraint	2.09 (1.36)	2.12 (1.25)	-0.21	.84
EDE-Q Eating Concern	1.48 (1.08)	1.75 (0.98)	-1.39	.18
EDE-Q Shape Concern	3.46 (0.70)	3.62 (0.66)	-2.08	.05
EDE-Q Weight Concern	3.51 (0.88)	3.74 (1.03)	-1.56	.13
BCQ Total	67.65 (15.94)	69.42 (12.05)	-0.79	.44
BCQ Overall Appearance	32.73 (6.79)	33.04 (5.85)	-0.37	.71
BCQ Specific Body Parts	24.04 (7.10)	24.65 (5.82)	-0.50	.63
BCQ Idiosyncratic Checking	10.88 (3.82)	11.73 (2.81)	-1.20	.24
BIAQ Total	36.19 (12.55)	35.92 (11.94)	0.29	.78

Note. BSQ = Body Shape Questionnaire; EDE-Q = Eating Disorder Examination-Questionnaire; BCQ = Body Checking Questionnaire; BIAQ = Body Image Avoidance Questionnaire.

## **Hypothesis 5a**

*H5a: Participants in both EMI groups will demonstrate adequate study compliance by completing at least 70% of the momentary questionnaires during the 14-day EMI study period.*

Hypothesis 5a was supported. The overall compliance rate across groups during the 14-day EMI protocol was 82.4%. Compliance rates for the NG-EMI and G-EMI groups were 75.6% and 88.4%, respectively.

## **Hypothesis 5b**

*H5b: Participants will indicate overall acceptance of this technology-based intervention as measured by responses to the post-test qualitative questions assessing self-monitoring feasibility and accuracy.*

Hypothesis 5b was generally supported. Participants provided feedback about the feasibility of the EMI study and the accuracy of their self-monitoring responses on a series of Likert scale survey questions at post-test. See Table 10 for mean responses for each feasibility and accuracy question.

Results from the Likert scale questions indicated that, overall, participants reported it was relatively feasible to complete the EMI prompts required in the study, but they would have also preferred fewer daily text messages or prompts and/or a shorter study period. Participants indicated that answering questions about their behaviors, thoughts, and emotions (i.e., self-monitoring) helped them keep track of those variables throughout the day. On average, participants were neutral when asked if tracking the frequency of their behaviors caused them to engage in the behaviors more or less often. Participants generally indicated they gave their best effort to provide accurate estimates of their behaviors, thoughts, and emotions when prompted throughout the day.

Table 10. *Mean Participant Responses to EMI Feasibility and Accuracy Questions at Post-Test*

	NG-EMI <i>n</i> = 19	G-EMI <i>n</i> = 22
How feasible was it for you to complete the questionnaires throughout the day?	5.16 (1.17)	5.27 (1.20)
I would have preferred to receive fewer text messages or prompts.	5.90 (1.11)	6.00 (1.02)
I would have been ok with receiving more text messages or prompts.	2.32 (1.16)	2.23 (1.11)
I would have preferred that the length of the study had been shorter.	5.11 (1.29)	5.27 (1.39)
I would have been ok if the study had continued longer.	2.37 (1.38)	2.23 (1.31)
Answering questions about my <i>behaviors</i> helped me keep track of them throughout the day.	4.84 (1.43)	5.12 (1.56)
Answering questions about my <i>thoughts</i> helped me keep track of them throughout the day.	5.53 (0.96)	5.68 (0.72)
Answering questions about my <i>emotions</i> helped me keep track of them throughout the day.	5.42 (1.07)	5.41 (1.18)
Answering questions about the frequency of my behaviors made me engage in the behaviors <i>less</i> often than I normally would.	4.05 (1.51)	4.18 (1.62)
Answering questions about the frequency of my behaviors made me engage in the behaviors <i>more</i> often than I normally would.	4.16 (1.34)	4.14 (1.46)
It was difficult for me to remember the number of times I engaged in certain behaviors.	4.11 (1.49)	4.09 (1.54)
It was difficult for me to remember the number of times I had certain thoughts.	4.32 (1.24)	4.18 (1.33)
If I was seeing a therapist or counselor, I think monitoring my behaviors, thoughts, and emotions throughout the day would be helpful.	5.03 (1.07)	5.51 (1.10)
If I was seeing a therapist or counselor for therapy, I would like to use my cell phone this way to monitor my behaviors, thoughts, and emotions throughout the day.	5.21 (1.48)	5.50 (1.01)
I believe I was accurate when estimating the frequency of my behaviors throughout the day.	5.00 (1.48)	5.41 (1.40)
I believe I was accurate when estimating the frequency of my thoughts throughout the day.	5.08 (1.02)	5.73 (0.94)
I believe I was accurate when estimating my emotions throughout the day.	5.11 (0.74)	5.82 (0.80)
I did my best to provide as accurate of a frequency number as possible for each questionnaire.	6.09 (0.57)	6.59 (0.50)
Please provide a percentage (0-100%) on how accurate you believe your reports of your frequency numbers were during this study.	80.05 (8.53)	82.59 (9.98)

Participants were also asked to provide feedback about the EMI study via an open ended prompt in the online post-test (See Table 11). Three major themes emerged in participants' responses: 1) noticing or gaining insight about their behaviors, thoughts, and emotions; 2) satisfaction with the text message intervention (i.e., G-EMI participants only); and 3) dissatisfaction with the study length and/or EMI procedures. The majority of participants indicated they gained some insight about the relationships between their body checking behavior, body dissatisfaction, and mood throughout the day due to self-monitoring. Several participants reported they were surprised or unaware of how often they engaged in body checking and how it impacted their body dissatisfaction and negative mood. Some participants indicated that, as a result of this awareness of their behavior patterns, they made an effort to (or planned to) reduce how often they engaged in body checking, weighing, and/or social comparison. In the G-EMI group, three participants provided positive feedback specific to the daily text message intervention. Finally, two participants in each EMI group indicated they felt the study was too long or the prompts were too burdensome to answer consistently.

Table 11. Participant Responses to Open-Ended Prompt for Study Feedback at Post-Test

Theme	NG-EMI Group	G-EMI Group
Noticed or gained insight about behaviors, thoughts, and emotions	<ul style="list-style-type: none"> <li>• <i>I liked this study. It kind of opened up my mind to how much I thought about my self negatively. I had to stop for a while to kind of get a hold of myself because I never realized how often I was so hard on myself. But I did like this study and I did think it was a good idea.</i></li> <li>• <i>I noticed that I checked/felt my body more often when I was self conscious or felt fat which usually made me feel worse about myself.</i></li> <li>• <i>I noticed I was in a bad mood during certain times of the day usually at night.</i></li> <li>• <i>I realized I check to make sure I look ok a lot</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>I noticed I look at myself in reflections A LOT, especially car windows. Sometimes I think "I look hot" and sometimes I realize I look like a wet rat and should probably brush my hair or something.</i></li> <li>• <i>One thing I noticed during this study is that I emotionally eat a lot when I'm stressed out or sad.</i></li> <li>• <i>I for sure feel worse about my body when I look at myself in the mirror too long or compare myself to my skinny friends. I suppose the whole point of this study was to point that out. I'm trying to be less critical about myself and comparing myself.</i></li> </ul>
Satisfaction with text message intervention		<ul style="list-style-type: none"> <li>• <i>I really liked the text that said to think about what my body can do, not what it looks like in the mirror.</i></li> <li>• <i>I have been trying to lose weight and I weigh myself a lot, like before and after I eat. Getting the texts made me realize I'm probably weighing myself too much. It was making me obsess about the number on the scale so I'm now trying to only weigh myself a few times a week.</i></li> </ul>
Dissatisfaction with study and/or EMI procedures	<ul style="list-style-type: none"> <li>• <i>This study was too long with too many texts. I liked the questions but it was hard to do it every day for 2 weeks.</i></li> <li>• <i>This study was fun but kind of long.</i></li> </ul>	<ul style="list-style-type: none"> <li>• <i>Cool concept but way too many texts and it was hard to fill out the surveys so many times when I'm busy.</i></li> <li>• <i>This study was different and interesting but it was hard to answer every time.</i></li> </ul>



## CHAPTER 4. DISCUSSION

The current study evaluated goal-directed self-monitoring as an ecological momentary intervention for disordered eating and body checking behaviors among non-clinical women who reported significant preoccupation or concern about body shape and weight. Participants were randomized into three study groups (NG-EMI, G-EMI, and control group) in order to investigate several specific aims and associated hypotheses.

First, this study examined momentary disordered eating and body checking behavior frequency as predictors of state body dissatisfaction and negative affect among participants in the two EMI groups. Hypothesis 1 was supported; both disordered eating and body checking behaviors significantly predicted state body dissatisfaction and negative affect. That is, when participants in the EMI groups reported engaging in a greater amount of disordered eating and body checking behaviors, they also reported worse body dissatisfaction and negative affect. Although temporal relationships were not established, these associations may suggest disordered eating and body checking behavior contributes to increased body dissatisfaction and negative mood among women who have significant pre-existing weight and shape concerns. This finding is consistent with the cognitive behavioral theory that engaging in increased body checking and other behaviors related to hypervigilance about eating, weight, and shape can maintain and possibly exacerbate body dissatisfaction and preoccupation (Fairburn, 2003). Fairburn et al. (1999) suggested as women continue to engage in body checking over time, they become hypervigilant about certain areas of their body, particularly areas that they dislike. This attentional bias may then serve to maintain body image dissatisfaction and negative affect (Smeets et al., 2011). The results of this study support this notion in that, in addition to disordered eating behaviors, momentary body checking behaviors predicted state body

dissatisfaction and negative affect. Although this theory has primarily concentrated on clinical eating disorder populations, results from the present study suggest this concept may be generalized to women with subclinical levels of eating disorder symptoms as well.

In addition to examining the associations between momentary thoughts and behaviors, this study primarily sought to determine if significant reactivity (i.e., reduction of target behaviors) occurred among participants over time during the 14-day self-monitoring period. Hypothesis 2, that time in study would be a significant predictor of target behavior frequency, was fully supported. Across both EMI groups, the number of times participants reported engaging in disordered eating and body checking behaviors throughout the day significantly reduced over time after controlling for social desirability score. Upon examining the two EMI groups separately, the negative relationship between time in study and ED and BC behavior frequency remained significant for both the NG-EMI and G-EMI groups. These findings suggest that significant reactivity to self-monitoring occurred for both groups. Excessive body checking and disordered eating behaviors have been associated with notable comorbid psychopathology and impairment (Mountford et al., 2006); from a treatment standpoint, they are considered negative behaviors that are often specifically targeted for intervention. Therefore, the observed reactivity in the present study occurred in a therapeutically-desired direction in that the “undesirable” target behaviors reduced in frequency during the self-monitoring period.

Next, the present study investigated if an additional intervention component (i.e., daily text-messages containing goal-directed information and psychoeducation) during the self-monitoring procedures would augment the reactive effects observed in Hypothesis 2. Hypothesis 3 was partially supported. Findings suggested body checking frequency, but not disordered eating behavior frequency, reduced at a faster rate among G-EMI participants who received the

daily text message intervention compared to NG-EMI participants who only engaged in self-monitoring. It is possible that including goal-directed information and psychoeducation about the study's target behaviors during the self-monitoring period further enhanced participants' motivation to reduce their body checking behavior (Kazdin, 1974). Previous research has supported the use of self-monitoring with a psychoeducational component as an intervention for eating-related pathology (Cash & Hrabosky, 2003). While it is unknown if the reported reductions in behavior frequency in the present study were sustained long-term among, the current results indicated self-monitoring, specifically with a goal-directed and psychoeducational component, may be a potentially valuable intervention tool for reducing body checking behavior short-term. Further, although a significant difference between the two EMI groups was only found for body checking frequency, it is possible disordered eating behavior might also decrease more significantly in the G-EMI group if observed for a longer period of time. Excessive body checking behavior is often considered to be directly related to existing eating pathology (Fairburn et al., 2003; Walker & Murray, 2012), and it is unclear how body checking and other associated disordered eating behaviors might change in relation to one another when self-monitored over an extended period of time. Future research should consider lengthening the self-monitoring period in order to investigate if more significant changes in the frequency of disordered eating behavior occur over time.

This study also examined if engaging in self-monitoring affected global eating disorder pathology, overall body checking behavior, and body shape concern as measured from the pre-test to post-test. Participants in the both EMI groups completed the post-test immediately after completing two weeks of self-monitoring, and participants in the control group completed the pre-test and two-week post-test without engaging in self-monitoring. Results from the present

study supported Hypothesis 4 in that EMI participants reported significantly lower scores on several post-test measures of disordered eating pathology while the control group did not show any significant differences from pre-test to post-test. After continuously self-monitoring their body checking and disordered eating behaviors, body dissatisfaction, and state negative affect for two weeks, the NG-EMI group reported significantly less body checking behavior related to their overall appearance at post-test, as indicated by the Overall Appearance Scale of the BCQ; no other significant differences were found between pre-test and post-test scores for the NG-EMI group. The G-EMI group reported significantly lower post-test scores on several measures of eating disorder pathology, including body checking related to overall appearance and specific body parts, global eating disorder pathology, and weight-related concern as measured by the EDE-Q Global and Weight Concern Scales. These findings provide further support for the effectiveness of the text message intervention component in the G-EMI group. It is possible participants in the G-EMI group reported significantly less eating disorder pathology at post-test not only due to the reactive effects of self-monitoring but also the addition of daily text messages with goal-directed information and psychoeducation. Although different methods were used to examine the effectiveness of the text message intervention for Hypotheses 3 and 4, overall results from both analyses were consistent in that the G-EMI group reported lower levels of disordered eating pathology over time and at post-test compared to the NG-EMI group. Taken together, findings from both hypotheses indicate that reactive effects of self-monitoring may be further augmented by including this goal-directed intervention in order to encourage the reduction of unwanted behaviors and increase insight about the negative effects of body checking and disordered eating behaviors (Cash & Hrabosky, 2003; Kazdin, 1974).

Finally, this study investigated the overall feasibility, acceptability, and perceived accuracy of the EMI procedures. Hypothesis 5a was supported; the overall compliance rates for both EMI groups were above 70%, which suggests that participants accepted the EMI procedures. Compliance rates observed in the present study were similar to previous eating-related EMA and EMI studies (e.g., Munsch et al., 2009; Smyth et al., 2000; Stefano et al., 2016). Although both EMI groups had good compliance rates, results indicated that participants in the G-EMI group had significantly greater compliance compared to the NG-EMI group. It is possible the addition of the text-message intervention resulted in greater commitment to the study's EMI procedures and understanding of its overall purpose. In addition to conveying the negative effects of body checking and disordered eating behaviors, the text messages also contained information about the importance of engaging in consistent self-monitoring in order to reduce these undesirable behaviors. This goal-directed information may have encouraged participants in the G-EMI group to respond to the questionnaire prompts more frequently and consistently compared to the NG-EMI group who only received the questionnaires throughout the 14-day study.

In addition to compliance rates, this study included qualitative prompts and Likert scale questions to obtain feedback from participants about the study's EMI procedures. Overall, Hypothesis 5b was supported in that participants in both EMI groups reported a general acceptance and satisfaction with the EMI portion of the study. Additionally, participants believed they were generally accurate when self-monitoring their behavior frequency, thoughts, and emotions. Participants' responses to the open-ended prompt asking for overall feedback about the study was relatively consistent with the quantitative findings. For example, several

participants reported that consistently self-monitoring caused them to notice how often they engaged in body checking and its impact on their body dissatisfaction and negative mood.

In both the Likert questions and open-ended prompt, participants reported they would have preferred fewer prompts and a shorter study period. Existing EMA and EMI studies related to eating disorders have included study periods ranging from several days, weeks, or months and have observed clinically and statistically significant results (Engel et al., 2016; Heron & Smyth, 2010). It is possible the present study might yield significant results with a shorter EMI period. Stefano et al. (2016) found a significant reduction in reported frequency of body checking behaviors during only a 5-day EMA self-monitoring period. However, despite participants' preferences for a shorter study or less frequent prompts, overall compliance was still high in the present study (82.4% for total EMI sample).

An interesting finding in participants' feedback about the study was that participants' scores were generally neutral when asked on the Likert question if self-monitoring their behaviors caused them to engage in the behaviors more or less often over time. This finding suggests that some participants did not perceive a change in the frequency of their behaviors one way or another despite the quantitative analyses indicating a reduction in body checking and disordered eating behaviors over time for both groups. It is possible that the rate at which behaviors reduced was *statistically* significant but not *clinically* significant. For example, results from Hypothesis 2 indicated that for every unit increase in time in study, a 0.13 unit decrease in body checking behavior was predicted, holding all other variables constant. It is possible that for some participants, change in behavior frequency over time was too small and went unnoticed. Another explanation for this discrepancy may be due to the fact that participants did not receive any individualized feedback about changes in their behavior frequency during the 14-day self-

monitoring period, so they were possibly less aware of any notable changes over time. Previous literature has suggested that providing consistent feedback to individuals who are self-monitoring may further increase reactivity in the desired direction (Kanfer, 1970; Korotitsch & Nelson-Gray, 1999). Fairburn and Rothwell (2015) also suggested that eating disorder patients should be able to observe their cumulative self-monitoring data throughout the day in order to provide the opportunity to independently identify behavior patterns and make changes in real time. Future studies should consider including a feedback component or an EMI platform that allows participants to observe potential changes in their self-monitoring data over time.

### **Strengths and Limitations**

The present study highlights the potential utility of self-monitoring as an intervention for disordered eating and body checking behaviors. In addition to the use of a randomized controlled design, a major strength of this study was the use of ecological momentary assessment and intervention via participants' personal mobile phones, which allowed participants to easily engage in consistent self-monitoring without undue burden or excessive study resources. This methodology also provided ecologically valid and rich longitudinal data about constructs that may not have been easily observed in a one-time laboratory setting (i.e., body checking, state body dissatisfaction and negative affect). Additionally, the present study included an ethnically diverse sample of women with subclinical eating disorder pathology, which may allow for better generalization to other populations with similar diverse demographics.

While the present study included many strengths, its limitations should be considered when interpreting the results. Although time in study significantly predicted a reduction in target behavior frequency during the self-monitoring period, it is unknown how long these reported effects lasted after the self-monitoring period ended. It is possible participants resumed engaging

in the body checking and disordered eating behaviors after the study ended at the same rate that was reported at the beginning of the self-monitoring period. Currently, there is limited research on the long-term sustainability of the reactive effects that occur during self-monitoring, and in the context of psychological treatment, self-monitoring is typically followed by or used in tandem with additional therapeutic interventions. Future research the unique effects of self-monitoring as an intervention should incorporate long-term follow-up assessments, including the use of EMA to assess the frequency of target behaviors in real time, in order to determine if behavior frequency returned to baseline rates or the reductions in behaviors were sustained over time.

A second limitation may be that participants in the EMI group were asked to self-monitor multiple behaviors during the 14-day study. Hayes and Cavior (1977) suggested recording more than one behavior can reduce the reactive effect of self-monitoring. Participants in the present study recorded several types of disordered eating and body checking behaviors, which may have affected the accuracy of their reported behavior frequency as well as the potential reactivity to self-monitoring. Future studies should examine if the number of self-monitored behaviors impacts the degree of reactivity, specifically when self-monitoring disordered eating behaviors.

The methods used to measure and statistically control for social desirability may also be considered a limitation in the present study. The Marlowe-Crowne Scale and its short forms have been extensively validated and widely used to assess and control for socially desirably response bias (e.g., Loo & Loewen, 2004; Loo & Thorpe, 2000). However, some studies have argued that the M-C scale and its short forms are structurally inadequate and may not truly capture response bias (Barger, 2002; Leite & Beretvas, 2005). Weinberger (1990) also suggested high scores on the M-C scale might reflect factual responding for some individuals who legitimately possess the



positive traits and tendencies described in the scale's items and, therefore, these scores should not be controlled for in subsequent analyses. Certainly, it would be difficult to distinguish these individuals from those who are engaging in socially desirable responding in most cases, including the present study. Further, social desirability was assessed only once at pre-test, and this score was used as a covariate in subsequent HLM analyses when examining the EMI data. The tendency to engage in socially desirable responding may fluctuate over time or in different situations; if so, this would suggest the need to assess social desirability at each EMI time point. However, the M-C scale and its short forms have demonstrated good test-retest reliability (Zook & Sipps, 1985), and incorporating an appropriate measure of momentary social desirability into each EMI questionnaire would be burdensome to participants.

Another limitation of the present study was the relatively small sample sizes. While the sample size of the two EMI groups was sufficient for the multilevel analyses, the limited sample sizes of all three study groups resulted in slightly underpowered paired sample t-tests in the analyses for Hypothesis 4. A power analysis conducted with the program *G\*Power* (Erdfelder, Faul, & Buchner, 1996) suggested a total sample size of 66 would provide sufficient power for paired sample t-tests with a significance level of  $\alpha = .01$ . In the present study, the sample sizes for each group ranged from  $n = 19 - 26$ . Although there were some significant results for Hypothesis 4, it is possible the use of larger study groups would yield more robust findings.

A final potential limitation was the use of a college sample recruited from introductory psychology courses. Although the sample was ethnically diverse, participants were similar to each other in age and other demographic variables, which may limit the ability to generalize the present findings to other samples and populations of interest.

## **Clinical Implications and Future Directions**

In addition to providing further support for the maintenance role of body checking in the cognitive behavioral theory for eating disorders, overall findings from the present study suggest self-monitoring with goal-directed information and psychoeducation may be an effective short-term intervention for reducing the frequency of body checking and disordered eating behaviors as well as more global measures of eating disorder pathology. While a reduction in behavior frequency was observed in participants engaging in only self-monitoring, there appeared to be an even greater reduction in body checking and post-test eating disorder pathology among participants who received daily text messages with goal-directed information and psychoeducation. The use of self-monitoring is a core treatment component of cognitive behavioral therapy for eating disorders, and findings from the present study underscore the potentially powerful benefits of self-monitoring as a sole intervention for reducing body checking and disordered eating behaviors among women with subclinical eating disorder pathology.

Further research may provide more insight into the use of reactive effects of self-monitoring as an intervention for disordered eating. Existing literature has cited other variables that could influence reactivity that were not addressed in this study (Kanfer, 1970; Korotitsch & Nelson-Gray, 1999), including factors such as participants' motivation to change their target behaviors, providing regular feedback about changes in behavior frequency, allowing participants to see their progress throughout the study period (i.e., self-assessment), the frequency of daily self-monitoring prompts, and the overall length of the self-monitoring period. Future research should explore the potential influence of these factors on reactivity during self-monitoring of disordered eating behaviors as they may further augment the reactive effects

observed in the present study. Continued research should also examine the potential sustainability of the reactive effects of self-monitoring by including more long-term follow up procedures after the initial self-monitoring period has been completed.

Future studies should also examine reactive effects of self-monitoring body checking and disordered eating behaviors among other populations, including eating disorder patients and individuals with varying levels of body concern, body dissatisfaction and weight status. While the present study observed a “desirable” reactive effect from self-monitoring (i.e., the frequency of pathological behaviors reduced over time), it is unknown if other populations would exhibit reactivity in a different direction.

Another potential area for future research is the use of electronic methods of self-monitoring as a component of eating disorder treatment in contrast to traditional paper-and-pencil methods. Recent literature directly comparing electronic and paper methods of self-monitoring is primarily limited to weight management research, and most studies have suggested electronic methods yielded superior data quality, compliance, and treatment success (e.g., Berkman, Giuliani, & Pruitt, 2015; Burke et al., 2012; Cushing, Jensen, & Steele, 2010). One eating disorder study compared EMA-based self-monitoring to traditional paper self-report questionnaires as a measurement of treatment efficacy for CBT for binge eating disorder (Munsch et al., 2009); findings suggested that the EMA method provided more detailed information about binge eating behavior, which allowed for more specific interventions in treatment. However, research has not yet examined the potential reactive effects and intervention properties of electronic self-monitoring compared to paper-and-pencil methods for reducing disordered eating behaviors. Considering the results of the current study, electronic self-monitoring may provide some benefits to paper-and-pencil methods. For example, current

findings suggested including goal-directed information might be an important factor for self-monitoring as an intervention; including daily goal-directed information and psychoeducation may be less feasible when using paper-and-pencil records compared to electronic methods.

Overall, findings support self-monitoring with goal-directed information and psychoeducation as a promising intervention for reducing body checking and eating disorder pathology among young women with high body concern and subclinical disordered eating. An additional avenue for future research should compare the efficacy of self-monitoring as a sole intervention compared to its use as a supplemental intervention with in-person treatment for eating disorders. Such research would provide additional insight into the unique strength of self-monitoring as an intervention or component of treatment.

## APPENDENCES

### APPENDIX A

#### Demographic Questionnaire

1. Age (years): \_\_\_\_\_
2. Year in College (please circle):
  - a. 1<sup>st</sup> year
  - b. 2<sup>nd</sup> year
  - c. 3<sup>rd</sup> year
  - d. 4<sup>th</sup> year
  - e. 5<sup>th</sup> year or greater
3. Marital Status (please circle):
  - a. Never married
  - b. Married
  - c. Divorced
  - d. Separated
  - e. Widowed
4. Please select the race that you most identify with:
  - a. African American, Black, African, Caribbean
  - b. East Asian (Chinese, Korean, Japanese, etc.)
  - c. South Asian (Indian, Pakistani, Sri Lankan, etc.)
  - d. Southeast Asian (Vietnamese, Cambodian, Filipino, etc.)
  - e. European American, White, Anglo, Caucasian
  - f. Hispanic American, Latino(a), Chicano(a), Mexican, Columbian
  - g. Pacific Islander (Micronesian, Melanesian, Samoan, etc.)
  - h. Native Hawaiian, American Indian, Alaskan Native
  - i. Biracial, Multiracial
5. In terms of ethnic groups, I consider myself to be: \_\_\_\_\_
6. How long have you lived in Hawaii (please circle):
  - a. Less than 3 months
  - b. 3-6 months
  - c. 6-12 months
  - d. Longer than 12 months
  - e. The majority of my life
7. Place of birth: \_\_\_\_\_

8. Is English your first language?

- a. Yes
- b. No

9. If English isn't your first language, please rate how fluent you are in English on a 1 to 5 scale (If English is your first language, please skip this question):

1	2	3	4	5
Not at all fluent				Very fluent

10. Current height (feet and inches): \_\_\_\_\_

11. Current weight (pounds): \_\_\_\_\_

12. Ideal weight that you would like to weigh (pounds): \_\_\_\_\_

13. Highest weight ever at your full height (in pounds): \_\_\_\_\_

14. Lowest weight ever at your full height (in pounds): \_\_\_\_\_

15. Have you ever been diagnosed with an eating disorder? Which one(s)? If no, enter "NA" or leave blank: \_\_\_\_\_

16. Date of your last menstrual period: \_\_\_\_\_

17. Are you currently using any form of hormonal birth control?    YES                      NO

18. If yes, please indicate which type (if no, leave blank):

- a. Oral contraceptive (the pill)
- b. Contraceptive patch
- c. Vaginal ring (NuvaRing)
- d. Injection (Depo-Provera)
- e. Intra-uterine System (IUD)
- f. Subdermal contraceptive implant
- g. Other, please specify \_\_\_\_\_

19. Have you ever been on a diet plan to lose weight? YES NO

20. Are you currently following a diet plan to lose weight? YES NO

21. If yes, please briefly describe your current diet plan:

---

22. I consider myself to be (please circle):

- a. Extremely underweight
- b. Underweight
- c. Normal Weight
- d. Overweight
- e. Obese

### Valence of Study Behaviors

For the following items, please choose the answer that best indicates your level of agreement with each statement.

23. I believe it is a good thing to check my body shape and size in the mirror many times throughout the day.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

24. I believe it is a good thing to weigh myself multiple times per day.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

25. I believe it is a good thing to stare at or scrutinize certain parts of my body that I dislike while looking in the mirror.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

26. I believe it is a good thing to make decisions about what to eat based on how my body looks right at that moment.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

27. I believe it is a good thing to avoid looking at my body after I have eaten.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

28. I believe it is a good thing to avoid looking at my body most of the time.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

29. I believe it is a good thing to compare the way that I look to others who look better than me.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

30. I believe it is a good thing to compare the way that I look to others who look worse than me.

1	2	3	4	5	6
Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree

31. Your cell phone number and email address will be kept confidential and will only be used for contacting you for study purposes.

Cell Phone: \_\_\_\_\_

Email: \_\_\_\_\_



## APPENDIX B

### Eating Disorder Examination – Questionnaire (EDE-Q)

The following questions are concerned with the past **four weeks (28 days)** only. Please read each question carefully and indicate your answer by **ticking ☒ the appropriate box on the right**. Please answer all questions.

#### ON HOW MANY DAYS OF THE PAST 28 DAYS -

	No days	1-5 days	6-12 days	13-15 days	16-22 days	23-27 days	Every day
1 Have you been deliberately <i>trying</i> to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?							
2 Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?							
3 Have you <i>tried</i> to exclude from your diet any foods which you like in order to influence your shape or weight (whether or not you have succeeded)?							
4 Have you <i>tried</i> to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?							
5 Have you had a definite desire to have an <i>empty</i> stomach with the aim of influencing your shape or weight?							
6 Have you had a definite desire to have a <i>totally flat</i> stomach?							
7 Has thinking about <i>food, eating or calories</i> made it very difficult to concentrate on things you are interested (for example, working, following a conversation or reading)?							
8 Has thinking about <i>shape or weight</i>							

made it very difficult to concentrate on things you are interested (for example, working, following a conversation or reading?

9 Have you had a definite fear of losing control over eating?

10 Have you had a definite fear that you might gain weight?


**ON HOW MANY DAYS OUT OF THE PAST 28 DAYS -**

0 days    1-5 days    6-12 days    13-15 days    16-22 days    23-27 days    Every day

11 Have you felt fat?

12 Have you had a strong desire to lose weight?


**Questions 13-18: Please fill in the appropriate number on the right. Remember that the questions only refer to the past 4 weeks (28 days).**

13 Over the past 28 days, how many *times* have you eaten what other people would regard as an *unusually large amount of food* (given the circumstances)?

(e.g. "12" =   1  2 )

14 On how many of these times did you have a sense of having lost control over your eating (at the time that you were eating)?

15. Over the past 28 days, on how many *days* have such episodes of overeating occurred (i.e., you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?

15b Have you had other episodes of eating in which you have had a sense of having lost control and eaten more than you would like, but *have not eaten a very large amount of food* given the situation? Over the past 28 days how many *days* approximately would this have happened?

16. Over the past 28 days, on how many *times* have you made yourself sick (vomit) as a means of controlling your shape or weight?

17. Over the past 28 days, on how many *times* have you taken laxatives as a means of controlling your shape or weight?

18. Over the past 28 days, on how many *times* have exercised in a 'driven' or 'compulsive' way as a means of controlling your shape or weight, or amount of fat, or to burn off calories?

**Questions 19-21: Please indicate the appropriate number. Please not that for these questions the term “binge eating” means eating what others of your age and gender would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.**

**ON HOW MANY DAYS OUT OF THE PAST 28 DAYS -**

0 days    1-5 days    6-12 days    13-15 days    16-22 days    23-27 days    Every day

19. Have you eaten in secret (i.e. furtively)?...Ignore episodes of binge eating

--	--	--	--	--	--	--

20. On what proportion of the times *that you have eaten* have you felt guilty (felt that you’ve done wrong) because of its effect on your shape or weight?...Ignore episodes of binge eating

None of the time    A few times    Less than half    Half of the times    More than half    Most of the time    Every time

--	--	--	--	--	--	--

**OVER THE PAST 28 DAYS:**

Not at all	Slightly		Moderately		Markedly	
0	1	2	3	4	5	6

21. How concerned have you been about other people seeing you eat?  
...Ignore episodes of binge eating

--	--	--	--	--	--	--

22. Has your *weight* (number on the scale) influenced how you think about (judge) yourself as a person?

--	--	--	--	--	--	--

23. Has your *shape* influenced how you think about (judge) yourself as a person?

--	--	--	--	--	--	--

24. How much would it have upset you if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?

--	--	--	--	--	--	--

25. How dissatisfied have you been with your *weight* (number on the scale)?

--	--	--	--	--	--	--

26. How dissatisfied have you been with your *shape*?

--	--	--	--	--	--	--

27. How uncomfortable have *you* felt seeing your body, (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?

--	--	--	--	--	--	--

28. How uncomfortable have you felt about *others* seeing your body (for example, in communal changing rooms, when swimming or when wearing tight clothes)?

--	--	--	--	--	--	--

## APPENDIX C

### Body Shape Questionnaire (BSQ-34)

We should like to know how you have been feeling about your appearance over the **PAST FOUR WEEKS**. Please read each question and circle the appropriate number to the right. Please answer all the questions.

**OVER THE PAST FOUR WEEKS:**

		Never	Rarely	Sometimes	Often	Very often	Always
1. Has feeling bored made you brood about your shape?.....	1	2	3	4	5	6	
2. Have you been so worried about your shape that you have been feeling you ought to diet?.....	1	2	3	4	5	6	
3. Have you thought that your thighs, hips or bottom are too large for the rest of you?.....	1	2	3	4	5	6	
4. Have you been afraid that you might become fat (or fatter)?.....	1	2	3	4	5	6	
5. Have you worried about your flesh being not firm enough?.....	1	2	3	4	5	6	
6. Has feeling full (e.g. after eating a large meal) made you feel fat?.....	1	2	3	4	5	6	
7. Have you felt so bad about your shape that you have cried?.....	1	2	3	4	5	6	
8. Have you avoided running because your flesh might wobble?.....	1	2	3	4	5	6	

- |  |   |   |   |   |   |   |
|--|---|---|---|---|---|---|
| 9. Has being with thin women made you feel self-conscious about your shape?.....<br>.....  | 1 | 2 | 3 | 4 | 5 | 6 |
| 10. Have you worried about your thighs spreading out when sitting down?  | 1 | 2 | 3 | 4 | 5 | 6 |
| 11. Has eating even a small amount of food made you feel fat?.....   | 1 | 2 | 3 | 4 | 5 | 6 |
| 12. Have you noticed the shape of other women and felt that your own shape compared unfavourably?.....   | 1 | 2 | 3 | 4 | 5 | 6 |
| 13. Has thinking about your shape interfered with your ability to concentrate (e.g. while watching television, reading, listening to conversations)?.....<br>..... | 1 | 2 | 3 | 4 | 5 | 6 |
| 14. Has being naked, such as when taking a bath, made you feel fat?.....   | 1 | 2 | 3 | 4 | 5 | 6 |
| 15. Have you avoided wearing clothes which make you particularly aware of the shape of your body?.....   | 1 | 2 | 3 | 4 | 5 | 6 |
| 16. Have you imagined cutting off fleshy areas of your body?.....  | 1 | 2 | 3 | 4 | 5 | 6 |

	Never	Rarely	Sometimes	Often	Very often	Always
17. Has eating sweets, cakes, or other high calorie food made you feel fat?	1	2	3	4	5	6
18. Have you not gone out to social occasions (e.g. parties) because you have felt bad about your shape?.....	1	2	3	4	5	6
19. Have you felt excessively large and rounded?.....	1	2	3	4	5	6
20. Have you felt ashamed of your body?.....	1	2	3	4	5	6
21. Has worry about your shape made you diet?.....	1	2	3	4	5	6
22. Have you felt happiest about your shape when your stomach has been empty (e.g. in the morning)?.....	1	2	3	4	5	6
23. Have you thought that you are in the shape you are because you lack self-control?.....	1	2	3	4	5	6
24. Have you worried about other people seeing rolls of fat around your waist or stomach?.....	1	2	3	4	5	6
25. Have you felt that it is not fair that other women are thinner than you?.	1	2	3	4	5	6
26. Have you vomited in order to feel thinner?.....	1	2	3	4	5	6
27. When in company have your worried about taking up too much room (e.g. sitting on a sofa, or a bus seat)?.....	1	2	3	4	5	6

- |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 28. Have you worried about your flesh being<br>dimply?.....   | 1 | 2 | 3 | 4 | 5 | 6 |
| 29. Has seeing your reflection (e.g. in a mirror or shop window)<br>made you feel bad about your<br>shape?.....               | 1 | 2 | 3 | 4 | 5 | 6 |
| 30. Have you pinched areas of your body to see how much fat there<br>is?.....   | 1 | 2 | 3 | 4 | 5 | 6 |
| 31. Have you avoided situations where people could see your body<br>(e.g. communal changing rooms or swimming<br>baths)?..... | 1 | 2 | 3 | 4 | 5 | 6 |
| 32. Have you taken laxatives in order to feel<br>thinner?.....  | 1 | 2 | 3 | 4 | 5 | 6 |
| 33. Have you been particularly self-conscious about your shape<br>when in the company of other<br>people?.....                | 1 | 2 | 3 | 4 | 5 | 6 |
| 34. Has worry about your shape made you feel you ought to<br>exercise?.....   | 1 | 2 | 3 | 4 | 5 | 6 |



## APPENDIX D

### Body Checking Questionnaire (BCQ)

Circle the number that best describes how often you engage in these behaviors at the present time.

- 1 = never  
2 = rarely  
3 = sometimes  
4 = often  
5 = very often

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| 1. I check to see if my thighs spread when I'm sitting down.                                       | 1 | 2 | 3 | 4 | 5 |
| 2. I pinch my stomach to measure fatness.  | 1 | 2 | 3 | 4 | 5 |
| 3. I have special clothes which I try on to make sure they still fit.                              | 1 | 2 | 3 | 4 | 5 |
| 4. I check the diameter of my wrist to make sure it's the same size as before.                     | 1 | 2 | 3 | 4 | 5 |
| 5. I check my reflection in glass doors or car windows to see how I look.                          | 1 | 2 | 3 | 4 | 5 |
| 6. I pinch my upper arms to measure fatness.   | 1 | 2 | 3 | 4 | 5 |
| 7. I touch underneath my chin to make sure I don't have a "double chin."                           | 1 | 2 | 3 | 4 | 5 |
| 8. I look at others to see how my body size compares to their body size.                           | 1 | 2 | 3 | 4 | 5 |
| 9. I rub (or touch) my thighs while sitting to check for fatness.                                  | 1 | 2 | 3 | 4 | 5 |
| 10. I check the diameter of my legs to make sure they're the same size as before.                  | 1 | 2 | 3 | 4 | 5 |
| 11. I ask others about their weight or clothing size so I can compare my own weight/size.          | 1 | 2 | 3 | 4 | 5 |
| 12. I check to see how my bottom looks in the mirror.  | 1 | 2 | 3 | 4 | 5 |
| 13. I practice sitting and standing in various positions to see how I would look in each position. | 1 | 2 | 3 | 4 | 5 |

14. I check to see if my thighs rub together.	1	2	3	4	5
15. I try to elicit comments from others about how fat I am.	1	2	3	4	5
16. I check to see if my fat jiggles.	1	2	3	4	5
17. I suck in my gut to see what it is like when my stomach is completely flat.	1	2	3	4	5
18. I check to make sure my rings fit the same way as before.	1	2	3	4	5
19. I look to see if I have cellulite on my thighs when I am sitting.	1	2	3	4	5
20. I lie down on the floor to see if I can feel my bones touch the floor.	1	2	3	4	5
21. I pull my clothes as tightly as possible around myself to see how I look.	1	2	3	4	5
22. I compare myself to models on TV or in magazines.	1	2	3	4	5
23. I pinch my cheeks to measure fatness.	1	2	3	4	5

## APPENDIX E

### Body Image Avoidance Questionnaire (BIAQ)

Circle the number which best describes how often you engage in these behaviors at the present time.

- 0 = Never
- 1 = Rarely
- 2 = Sometimes
- 3 = Often
- 4 = Usually
- 5 = Always

I wear baggy clothes.	5	4	3	2	1	0
I wear clothes I do not like.	5	4	3	2	1	0
I wear darker color clothing.	5	4	3	2	1	0
I wear a special set of clothing, e.g. my “fat clothes”	5	4	3	2	1	0
I restrict the amount of food I eat.	5	4	3	2	1	0
I only eat fruits, vegetables and other low calorie foods.	5	4	3	2	1	0
I fast for a day or longer.	5	4	3	2	1	0
I do not go out socially if I will be “checked out.”	5	4	3	2	1	0
I do not go out socially if the people I am with will discuss weight.	5	4	3	2	1	0
I do not go out socially if the people I am with are thinner than me.	5	4	3	2	1	0
I do not go out socially if it involves eating.	5	4	3	2	1	0
I weigh myself.	5	4	3	2	1	0
I am inactive.	5	4	3	2	1	0
I look at myself in the mirror.	5	4	3	2	1	0
I avoid physical intimacy.	5	4	3	2	1	0
I wear clothes that will divert attention from my weight.	5	4	3	2	1	0
I avoid going clothes shopping.	5	4	3	2	1	0
I don’t weight “revealing” clothes (e.g. bathing suits, tank tops, or shorts).	5	4	3	2	1	0
I get dressed up or made up.	5	4	3	2	1	0

## APPENDIX F

### Marlowe-Crowne Social Desirability Scale – Version C Short Form

*Listed below are a number of statements concerning personal attitudes and traits. Read each item and decide whether the statement is TRUE or FALSE as it pertains to you personally.*

1. It is sometimes hard for me to go on with my work if I am not encouraged.

FALSE

TRUE

2. I sometimes feel resentful when I don't get my way.

TRUE

FALSE

3. On a few occasions, I have given up doing something because I thought too little of my ability.

TRUE

FALSE

4. There have been times when I felt like rebelling against people in authority even though I knew they were right.

TRUE

FALSE

5. No matter who I am talking to, I'm always a good listener.

TRUE

FALSE

6. There have been occasions when I took advantage of someone.

TRUE

FALSE

7. I'm always willing to admit it when I make a mistake.

TRUE

FALSE

8. I sometimes try to get even rather than forgive and forget.

TRUE

FALSE

9. I am always courteous, even to people who are disagreeable.

TRUE

FALSE

10. I have never been irked when people expressed ideas very different from my own.

TRUE

FALSE

11. There have been times when I was quite jealous of the good fortune of others.

TRUE

FALSE

12. I am sometimes irritated by people who ask favors of me.

TRUE

FALSE

13. I have never deliberately said something that hurt someone's feelings.

TRUE

FALSE

## APPENDIX G

### Feasibility Questions

During the past two weeks of this study, how feasible was it for you to complete these questionnaires throughout the day (please circle)?

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Not at all feasible</b>			<b>Neutral</b>			<b>Very feasible</b>

*Please answer to what degree you agree or disagree with the following statements.*

1. I would have preferred to receive fewer text messages or prompts (less than 5 per day) to complete the questionnaire throughout the day.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

2. I would have been ok with receiving more text messages or prompts (more than 5 per day) to complete the questionnaire throughout the day.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

3. I would have preferred that the length of the portion of the study in which I received text messages throughout the day had been shorter (less than 2 weeks).

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

4. I would have been ok if the portion of the study in which I received text messages had continued longer (greater than 2 weeks).

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

5. Answering questions about my behaviors helped me keep track of them throughout the day.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

6. Answering questions about my emotions helped me keep track of them throughout the day.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

7. Answering questions about my thoughts helped me keep track of them throughout the day.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

8. Answering questions about the frequency of my behaviors made me engage in the behaviors LESS often than I normally would.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

9. Answering questions about the frequency of my behaviors made me engage in the behaviors MORE often than I normally would.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

10. It was difficult to remember the number of times I engaged in certain behaviors.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

11. It was difficult to remember the number of times I had certain thoughts.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

12. If I was seeing a therapist or counselor, I think monitoring my behaviors, thoughts, and emotions throughout the day would be helpful.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

13. If I was seeing a therapist or counselor for therapy, I would like to use my cell phone this way to monitor my behaviors, thoughts, and emotions throughout the day.

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

14. *Please provide any additional thoughts or comments you may have about your experience monitoring your behaviors, thoughts, and emotions in this study:*

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## Accuracy Questions

*Please indicate the degree to which you agree or disagree with the following statements.*

1. I believe I was accurate when estimating the frequency of my behaviors throughout the day.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

2. I believe I was accurate when estimating the frequency of my thoughts throughout the day.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

3. I believe I was accurate when estimating my emotions throughout the day.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

4. I did my best to provide as accurate of a frequency number as possible for each questionnaire.

1	2	3	4	5	6	7
<b>Strongly Disagree</b>			<b>Neutral</b>			<b>Strongly Agree</b>

5. *Please provide a percentage on how accurate you believe your reports of your frequencies were during this study, with 0% indicating that you believe you were not accurate at all and 100% indicating that you believe you were perfectly accurate.* \_\_\_\_\_

## APPENDIX H

### EMI Eating & Weight-Related Behaviors

1. When did you last eat?
  - a. I have not yet eaten today.
  - b. I am currently eating.
  - c. Less than 1 hour ago
  - d. 1-3 hours ago
  - e. 3-5 hours ago
  - f. More than 5 hours ago
2. When you most recently ate, how much [1 = not at all; 5 = very much]:
  - a. Did you try to limit the amount of food you ate?
  - b. Were you concerned about other people seeing you eat?
  - c. Did you eat an unusually large amount of food given the circumstances?
  - d. Were you afraid of losing control over your eating?
  - e. Did you try to follow rules regarding your eating (e.g., calorie limit, rules about what or when to eat)?

*Please enter the number of times you have engaged in the following behaviors since you awoke this morning (or were last contacted):*

1. Thought about your weight and body shape: \_\_\_\_\_
  - a. My recent thoughts about my weight and body shape were:
    - i. Very Negative
    - ii. Somewhat Negative
    - iii. Neutral
    - iv. Somewhat Positive
    - v. Very Positive
2. Checked the calorie or nutrition content on a food label: \_\_\_\_\_
3. Made a decision to eat or not eat based on your weight/shape: \_\_\_\_\_
4. Ate in response to a negative mood (emotional eating): \_\_\_\_\_

## APPENDIX I

### EMI Body Checking Behaviors

*Please enter the number of times you have engaged in the following behaviors since you awoke this morning (or were last contacted):*

Weighed yourself: \_\_\_\_\_

Felt body parts for fatness: \_\_\_\_\_

Sucked in stomach: \_\_\_\_\_

Felt/Pinched your stomach to measure fatness: \_\_\_\_\_

Compared your body to other individuals around you: \_\_\_\_\_

Checked body size in the mirror or reflective surface: \_\_\_\_\_

Checked to see if thighs spread while sitting down: \_\_\_\_\_

## APPENDIX J

## PANAS-X

*This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel each emotion RIGHT NOW AT THIS MOMENT.*

1	2	3	4	5
Very light or not at all	A little	Moderately	Quite a bit	Extremely

- ☐ Irritable
- ☐ Disgusted with self
- ☐ Sad
- ☐ Afraid
- ☐ Alone
- ☐ Upset
- ☐ Blue
- ☐ Guilty
- ☐ Nervous
- ☐ Lonely
- ☐ Hostile
- ☐ Jittery
- ☐ Ashamed
- ☐ Scared
- ☐ Angry at self
- ☐ Downhearted
- ☐ Distressed
- ☐ Blameworthy
- ☐ Dissatisfied with self

## APPENDIX K

### Body Image States Scale (BISS)

*For each of the items below, check the box beside the one statement that best describes how you feel RIGHT NOW AT THIS VERY MOMENT. Read the items carefully to be sure the statement you choose accurately and honestly describes how you feel right now.*

1. Right now I feel . . .
  - ***Extremely dissatisfied*** with my physical appearance
  - ***Mostly dissatisfied*** with my physical appearance
  - ***Moderately dissatisfied*** with my physical appearance
  - ***Slightly dissatisfied*** with my physical appearance
  - ***Neither dissatisfied nor satisfied*** with my physical appearance
  - ***Slightly satisfied*** with my physical appearance
  - ***Moderately satisfied*** with my physical appearance
  - ***Mostly satisfied*** with my physical appearance
  - ***Extremely satisfied*** with my physical appearance
  
2. Right now I feel . . .
  - ***Extremely satisfied*** with my body size and shape
  - ***Mostly satisfied*** with my body size and shape
  - ***Moderately satisfied*** with my body size and shape
  - ***Slightly satisfied*** with my body size and shape
  - ***Neither dissatisfied nor satisfied*** with my body size and shape
  - ***Slightly dissatisfied*** with my body size and shape
  - ***Moderately dissatisfied*** with my body size and shape
  - ***Mostly dissatisfied*** with my body size and shape
  - ***Extremely dissatisfied*** with my body size and shape
  
3. Right now I feel . . .
  - ***Extremely satisfied*** with my weight
  - ***Mostly dissatisfied*** with my weight
  - ***Moderately dissatisfied*** with my weight
  - ***Slightly dissatisfied*** with my weight
  - ***Neither dissatisfied nor satisfied*** with my weight
  - ***Slightly satisfied*** with my weight
  - ***Moderately satisfied*** with my weight
  - ***Mostly satisfied*** with my weight
  - ***Extremely satisfied*** with my weight

4. Right now I feel . . .
- ***Extremely*** physically ***attractive***
  - ***Very*** physically ***attractive***
  - ***Moderately*** physically attractive
  - ***Slightly*** physically attractive
  - ***Neither attractive*** nor ***unattractive***
  - ***Slightly*** physically ***unattractive***
  - ***Moderately*** physically ***unattractive***
  - ***Very*** physically ***unattractive***
  - ***Extremely*** physically ***unattractive***
5. Right now I feel . . .
- ***A great deal worse*** about my looks than I usually feel
  - ***Much worse*** about my looks than I usually feel
  - ***Somewhat worse*** about my looks than I usually feel
  - ***Just slightly worse*** about my looks than I usually feel
  - ***About the same*** about my looks as usual
  - ***Just slightly better*** about my looks than I usually feel
  - ***Somewhat better*** about my looks than I usually feel
  - ***Much better*** about my looks than I usually feel
  - ***A great deal better*** about my looks than I usually feel

## APPENDIX L

### Examples of Goal-Directed and Psychoeducational Messages for the G-EMI Group

#### **Self-Monitoring:**

- “Self-monitoring (keeping track of your behaviors and thoughts) can help you identify patterns that may be occurring that you hadn’t noticed before.”
- “Self-monitoring of unpleasant or undesirable behaviors is likely to decrease the amount those behaviors occur.”
- “It is important to self-monitor and track several times throughout the day in order to get the most accurate information.”
- “One important purpose of self-monitoring is to decrease the frequency of behaviors that may cause you harm or feelings of distress.”

#### **Psychoeducation:**

- “Research shows that frequent body checking (e.g., looking at yourself in the mirror, feeling stomach for fatness, etc.) can lead to an increase in self-critical thoughts, negative emotions, and feelings of fatness.”
- “Sometimes a person may repeatedly check their body shape because they feel anxious about how they look. Research shows that repeated checking can actually *increase* anxiety and preoccupation about body shape over time.”
- “Repeated checking of body parts (e.g., legs, stomach) may intensify concerns about body shape and increase body dissatisfaction.”
- “Repeated checking of body parts (e.g., legs, stomach) magnifies the “imperfections” seen in the mirror.”
- “Studies show that repeated body checking can increase the intensity of “feeling fat” and negative thoughts about one’s weight and shape.”
- “Body weight can fluctuate by several pounds throughout the day due to many factors such as when you last ate, used the bathroom, drank liquids, heaviness of clothing, and current stage of menstrual cycle.”
- “Frequent weighing of oneself can lead to an increase in anxiety and preoccupation about body shape, eating, and weight.”
- “Frequent weighing is unhelpful as it can lead to preoccupation with weight and gives information that is easily misleading. Weight fluctuates throughout the day and is influenced by many factors.”
- “Research shows that comparing the way you look to others around you can lead to greater body dissatisfaction and negative emotions.”

## APPENDIX M

### Manipulation Check for G-EMI Group

Based on the information that was texted to you daily throughout the study, please answer the following questions:

1. Research shows that women who frequently look at their bodies in the mirror tend to be more satisfied or happier with their body.  
a. True  
\*b. False
2. Self-monitoring of unpleasant or undesirable behaviors is likely to decrease the amount those behaviors occur.  
\*a. True  
b. False
3. Weighing oneself multiple times throughout the day is an accurate way to determine if one has gained or lost any body fat.  
a. True  
\*b. False
4. Studies show that repeated body checking can increase the intensity of “feeling fat” and negative thoughts about one’s weight and shape.  
\*a. True  
b. False
5. Typically, checking one’s body shape/size repeatedly throughout the day results in a *decrease* in anxiety and preoccupation about weight over time.  
a. True  
\*b. False



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